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Factory Storekeeping and Material Control

The First Article—How Material Control Is Related to Production—The Ideal Material System—Losses from Excessive or Deficient Supply

BY HENRY H. FARQUHAR

A MANUFACTURING establishment, as the name implies, exists primarily for the purpose of turning out a product for sale at a profit. This fact curiously enough seems sometimes to be overlooked. Activities, other than production proper, are of course necessary in order that the main purpose for which the plant exists may be accomplished and it is necessary, in order to avoid an unevenness in management, that each activity be seen in true perspective to every other activity without misleading lights and shadows.

The main functions in the administration of any manufacturing undertaking are:

The financing and accounting, or the raising and regulation of funds by which the business is carried on.

The engineering or technical which determines the design and composition of the product.

Selling which creates a demand for and disposes of what is manufactured.

Personnel which has to do with the policies and practices grouping themselves about the human element.

All minor activities of the plant may be grouped under one or another of these broad major functions, and all, it must be remembered, spring from and must primarily serve production since this is the activity for which the whole establishment was founded. Looking at the matter in this light, the production function really embraces finance, engineering, selling and personnel. But it may in turn be subdivided into those activities with which it is more specifically concerned in turning out a product through the use of land and buildings, equipment, layout, organization, materials, production cost systems, and so on.

Now, if we have learned anything from the great amount of careful work which has been done in an attempt to reduce the management of industry to less of an art and more of a science, it is that the control of one of these variables with which the manager must deal is just as necessary as the control of any other and that the business must be looked upon as an organic whole and not as a series of disjointed and unrelated activities. This viewpoint brings home at once the fact that none of these production activities can continue unless selling provides a market, that machines are useless unless power is available to drive them, that men are useless unless they be provided with work to do and with facilities to do it, and that in turn all of these activities must cease unless materials are supplied as needed. The function of material supply, instead of being relegated to the background and considered as a necessary evil, must thus take its place alongside of those activities ordinarily given greater consideration. Only by so doing may a balanced management be brought about. Only when material regulation has been standardized may it be pushed to the background to make room for some of its brothers which are less amenable to control. One of the major activities of production, then, is to provide its needs in materials. It is only through the conduct of manufacturing operations that the material problem in the strictly manufacturing business originates. Eliminate the production activity and the need of materials, aside from miscellaneous office supplies and the like, disappears.

From a material standpoint the fundamental idea upon which war is conducted is so to organize and manage that the man at the front is enabled to keep his mind continuously on his main duty—the defeat of the enemy—without being handicapped with questions of supplies of any kind. He should absolutely forget the material. Ideally and actually he should be able to reach his hand behind him at any time and receive exactly what he needs—no more, no less—at the moment. An oversupply will impede his actions, consume his time and attention and result in waste. A deficiency will render him helpless. That is the basis upon which the supply service of the army is organized. Material and ration supply should be automatic and governed absolutely by current needs.

For the man at the front substitute the man at the machine, and the above ideal becomes that of the supply service in the factory for the same reasons, and to be attained through the same considerations.

THIS is the first of a series of seven articles. It shows the dependence of production upon material regulation.

The next three installments will deal with the personnel, organization and location of departments, the balance sheets and the purchasing department, as related to material control.

The last three installments will take up storeroom layout, equipment, stowage and protection, and maintenance stores.

Material control is a production function and should be governed by requirements for production during reasonable future periods.

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Now, to make this supply automatic in either case, we must first know the requirements. We must know the original outfit that a man needs when he takes up his work and the probable rate of use of each article while on the job. Then, if we are to send forward the right quantity of the right materials to him at just the right time, many other things are necessary. We must know how long it takes to secure the goods from our supplier, and how long it takes us to forward them from ourselves to the man who is to use them. We must know how much of the goods we have on hand in our storeroom, how much we have ordered to be shipped to us, how much has been promised for specific uses and therefore will not be available for filling subsequent requests, and we must know from this how much is still available for future demands. Besides these things, to make the supply reliable we must have a definite location for each article of goods in stock, to know exactly where and how much of each is on hand, and to be able to get them in and out quickly.

This requires that means be taken to safeguard materials in storage and to keep accurate records of amounts. We must have accuracy in handling, have all items checked all the way down the line as much as we possibly can consistent with speed and with the men with whom we work. Theoretically no goods may pass out of one's hands without a receipt. This is not always possible in war, or necessary in war or industry. But we must have efficient transportation and sufficient checks at each stage of our transportation. We must, therefore, have proper identification of the goods so as to enable anyone into whose hands they pass, to know what the goods are and for whom they are intended.

In addition to all these considerations of quantity and time, we also have both in war and in industry considerations of quality, and in addition to this in industry we have the further consideration of cost. By this is meant not simply the original purchase cost, but the final use or time cost considering the effectiveness and durability of the particular item in actual use.

These are a few of the many details to be brought under control in well-regulated material handling. They are not matters to be looked after by an inexperienced clerk, nor left to the supervision of otherwise preoccupied officials or those who, because their duties do not bring them face to face daily with production troubles, may not realize the vital dependence of manufacturing efficiency upon material control.

There is, strictly speaking, no such thing as a material function in itself in the manufacturing business. Those manufacturers who, in addition to producing, deliberately indulge in the buying of materials for resale and playing the market are by so much engaging in a separate line of business as distinct as possible from that for which presumably their investment in plant and equipment was made. It is a dangerous speculative business in which, in many cases, it is better not to indulge. Even though a conscious buying for resale be not permitted, there are many plants which are in even a worse condition, because, lacking this definite speculative policy, they have failed to substitute the proper one of governing purchase from the standpoint of manufacturing needs.

The tendency in the best plants today is to look upon the control of material as a production function and to govern the replenishment of materials by the requirements for production during a reasonable future period. One of the oldest, largest, and most progressive metal-working plants in this country adheres steadfastly to this policy, and has done so for a number of years.

The vital dependence of manufacturing efficiency on the strict regulation of materials is most realized by those closest to and responsible for production. Although a blunder on the part of the purchasing agent, for example, may result in just censure of that individual, it is after all production which has to bear the cost of the blunder. The cost of what he buys, as well as the cost of his failure to buy when he should, alike must eventually be borne by the cost of the product turned out. This is regardless of the cost methods used. Even where a so-called standard or predetermined cost of material entering the product is used, and where any excess over this cost is charged to profit and loss, the balance sheet must yet show that articles produced are sold at more than all costs of producing them, blunders included, or the business must eventually discontinue. We only obscure the approach of the evil by absorbing such losses in a separate account.

> ALL COSTS are the costs of production. The only economic justification for storing materials in quantity is that through this reservoir production may be regularized and cheapened.
>
> Excessive supply means loss in interest and insurance, excess storage space rent, deterioration, reduced stock turnover, additional handling and confusion.
>
> Deficient supply stops production. One occurrence may offset many times the cost of excessive supply.

Production must, therefore, suffer, in addition to leaks, any evils of over- or under-stocking. Curiously enough both of these losses are most often encountered in the same plant simply because insufficient attention is paid to material problems in general.

The only economic justification for storing materials in quantity is that through this reservoir production may be regularized and thus cheapened. It therefore follows that the cost of the product must not be unduly increased through storing too much nor through failure to store enough. In either event, production is not securing the benefit of storage to which it is entitled. There are but two ways in which materials may be sold at a profit. They may be resold in the condition in which they were bought at higher than the purchase price, or they may be processed to a finished or partly finished state and sold for more than the cost of raw material plus manufacture. Obviously excess materials cannot be processed, which leaves us only the first alternative of resale, as before stated a questionable policy for a manufacturing concern.

The now classic case of a government establishment may be recalled in this regard. There was here, of course, no element of speculation, but the loose methods of regulating materials then prevalent and still common, were in use. Upon the initiation of changed methods of management, the stores situation was thoroughly

overhauled. Among other things which came to light was a supply of materials above current needs amounting to over $122,000. This occurred in a government institution, however, for which allowances must be made.

Let us look at some happenings in private plants. I can personally vouch for the accuracy of these stories, although, of course, names cannot be mentioned. In a machine shop, upon a similar round-up forty tons of idle stock were unearthed from around the machines, under the benches, and on the floor of one department. This consisted of raw stock cached by the workmen, excessive amounts delivered to the machine and not disposed of, partly worked parts sidetracked for "rush" jobs, and so on. There was no speaking acquaintance between material regulation, either purchasing or issuing, and production needs.

Buying For Current Needs

In one plant I was informed that the purchasing agent bought only for current needs as judged from comparison of reports of materials on hand and sales orders which were furnished him. Because the responsibility for such matters was so placed and because of the methods used, his ability to buy for current needs was questioned although he surpassed the average purchasing agent in capability. An actual investigation showed over $50,000 worth of excess miscellaneous items on hand. Any of these items could have been secured in three weeks, and some were on hand in sufficient quantities to last ten years. The intent was good in this case, but human limitations and faulty details made its accomplishment an impossibility.

The purchaser for one medium-size factory was a bargain hunter, one of the most costly and tenacious diseases to which purchasing agents' flesh is heir. Responsibility for designation of how much to buy had, up to this time, never been clearly defined, and was usually exercised by the purchasing agent alone who originated and approved replenishment orders unless some special occurrence made consultation necessary. I remember very vividly how one morning he beamed into the office with the news that there had just been delivered 18 months' supply of a certain item which he had obtained at an "exceptional reduction in price." The works manager replied that they had just discontinued the use of that particular item altogether. In this case the material was immediately resold at a lower price than was paid for it. Such bargains often form very considerable portions of the excess supplies shown up when materials on hand are measured against requirements.

A somewhat elaborate stores system had been installed for keeping track of partly worked parts in another factory. Due to a multiplicity of detail whereby the main requirements of successful stores management, however, had been missed, the difference in inventory as shown on three supposedly accurate interlocking records was surprising. Material worth $15,000, as per the book records under the control of the cost department, could not be physically located or otherwise accounted for. Those entrusted with the work of record-keeping did not realize the importance of it and had no particular incentive to keep it accurately. The cost man regretted that it was necessary to write off such a loss, but otherwise attached no particular significance to the matter.

Akin to this is the case in another plant where, so far as I know to this day, the works manager in all important cases must send a personal representative to the storeroom to check the accuracy of the book balance reported to him from the balance sheets. These are under the control of the cost office.

Another case came to light in an otherwise exceptionally progressive factory. Because of fairly uniform production requirements, it was thought to be unnecessary to apportion, or reserve on the books, material for each manufacturing order in advance of its disbursement. Instead, the average consumption over a period of weeks was determined, to which was added a liberal factor for safety and the resulting quantity was specified as the minimum below which goods on hand should not be allowed to fall without issuing a replenishment order. This minimum was entered on the balance sheet for the item and book balances were carefully checked with bin contents from time to time. To give added assurance, over the minimum quantity in the bin was placed a red cloth as a signal to the storekeeper, before touching the minimum stock, to remind the balance clerk to issue a replenishment order.

This procedure seemed to be watertight, but after a few months' operation a costly shortage occurred on the item. Upon investigation it was found that recent demands had so far exceeded average demands upon which the minimum was based, that the stock became exhausted. Rather than increase the minimum limit to cover such exceptional demands and thereby increase the inventory of idle material during all times of normal consumption, the firm was persuaded to adopt the common-sense policy of looking ahead in these matters and apportioning all such material immediately the need became known.

No, efficiency in production cannot be obtained under such handicaps. Money is carefully guarded and checked to the penny. Materials are potentially of far greater importance to the manufacturing business than an equivalent amount of money. They should be as carefully guarded and controlled.

Losses from Excessive Supply

Excess materials undisposed of, cause any one or all of the following losses:

(1) Loss of interest on investment. The money which is spent for material in excess of what is needed for production during a reasonable period might otherwise be loaned at interest or reinvested profitably in the business, and might thus produce more money. Or it may be used to obviate the necessity of borrowing, and thus produce a direct saving. Invested in idle material, however, it adds a cost of doing business, the cost of the loss of interest on money needlessly spent.

(2) Loss of insurance on goods. A heavy inventory imposes a heavy insurance cost, or a heavy loss in case of fire, usually both.

(3) Excess storage space. Every cubic foot of storage space has a rental value. Taxes, insurance, depreciation and repairs on the building, interest on investment, heat, light, cleaning, all such costs for any space throughout the plant must be charged against what occupies that space, be it an operating machine or dead stock. This charge must eventually appear against the cost of the product which the space is supposed to benefit. In the former case, the product of the machine may offset, or more than offset, these rental charges. In the latter case the charges swell expenses which ordinarily cannot be returned by the

excess materials themselves and which therefore add to the burden which must otherwise be shouldered.

(4) Deterioration. In but few cases do materials of any kind retain their original quality during the passage of time. Deterioration, depreciation or obsolescense will sooner or later cause a loss in idle stock.

(5) Reduced stock turnover. During normal times of the buying and selling market the ideal condition as regards storage in the manufacturing business would be where no storage whatever is necessary. Imagine a factory where immediately upon receipt, raw material is delivered to the machine, processed at once and immediately shipped upon completion. Such a factory would have a stock turnover limited only by the time necessary for the longest operation on the product. The cost of material entering into the product under such conditions would obviously be less than where storage is necessary. In storing we have the costs mentioned previously, the cost of added delivery, handling and transportation charges, and possibly deterioration or obsolescence in the materials themselves.

No matter for how short a period we store, therefore, the cost of the stored article issued to the shop is actually greater, whether it shows on cost records or not, than is the cost of a non-stored article. The profit on the finished product is therefore less; or, if the same, that part of it which pertains to the materials occurs fewer times per year. It is more profitable to make 2 per cent per transaction six times a year than it is to make 13 per cent only once a year. This is a point overlooked in innumerable manufacturing and other concerns.

(6) Additional handling and confusion. Except under fortunate conditions of ample and well-arranged storage space, a supply of material in excess of normal needs almost inevitably results in shifting locations, additional piling, unpiling and transporting, additional record-keeping, lack of definite identification and consequent confusion and difficulty in finding materials quickly.

The losses which may and do result from a failure to have on hand just the article desired in sufficient quantity when needed are too frequent and obvious to merit rehearsal. A warning may be thrown in here, furthermore, to the effect that when a policy of governing materials strictly by production needs is determined upon, ample safeguards are necessary to insure against a shortage. One such occurrence may offset many times the cost of an excessive supply.

Material losses are also due to misplaced responsibility and faulty routine. Some typical instances of such losses were given in preceding paragraphs, and since the causes may be innumerable no summary will be attempted. It is largely the petty annoyances and little leaks, however, which in themselves are often insignificant, but which in the aggregate amount to infinitely more than it would cost to remedy them.

Progress of S. A. E. Standards Adoption in the Tractor Industry

The accompanying chart was exhibited at the recent National Tractor Show, at Minneapolis, by the Society of Automotive Engineers. It is based on replies to a questionnaire sent by the society to more than 100 tractor makers. On it are the names and symbols of the respective standards applicable to the tractor, and opposite each the number of tractor builders, as shown by the black spaces and expressed in per cent of the total number of replies to the questionnaire, who are employing them.

It is worthy of note by builders of other kinds of machinery that encouraging progress has been made by the tractor people in the adoption of standards that would be equally useful for other machinery. See, for example, the relatively large per cent of tractor builders who have adopted standard screw threads, lock washers, cotter pins, pipe threads, pipe fittings, grease cups, drain cocks, iron and steel specifications and annular ball-bearings.

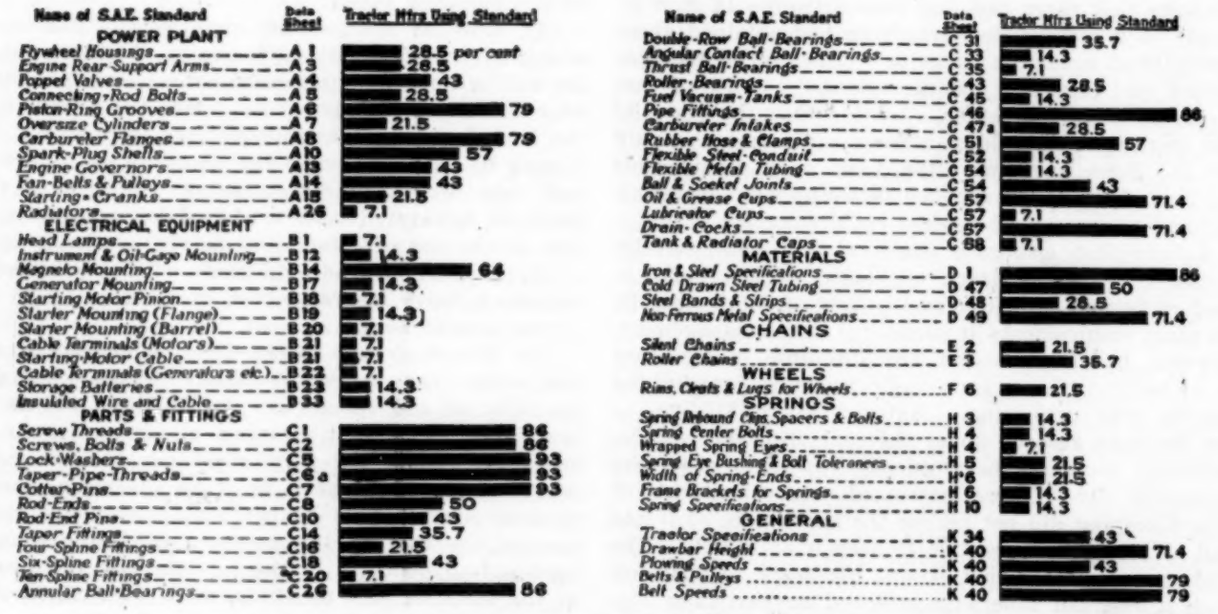
Name of S.A.E. Standard
Data Sheet
Tractor Mfrs Using Standard
POWER PLANT
Flywheel Housings A 1 28.5 per cent
Engine Rear Support Arms A 3 28.5
Poppet Valves A 4 43
Connecting-Rod Bolts A 5 28.5
Piston-Ring Grooves A 6 79
Oversize Cylinders A 7 21.5
Carbureter Flanges A 8 79
Spark-Plug Shells A 10 57
Engine Governors A 13 43
Fan-Belts & Pulleys A 14 43
Starting-Cranks A 15 21.5
Radiators A 26 7.1
ELECTRICAL EQUIPMENT
Head Lamps B 1 7.1
Instrument & Oil-Gage Mounting B 12 14.3
Magneto Mounting B 14 64
Generator Mounting B 17 14.3
Starting Motor Pinion B 18 7.1
Starter Mounting (Flange) B 19 14.3
Starter Mounting (Barrel) B 20 7.1
Cable Terminals (Motors) B 21 7.1
Starting-Motor Cable B 21 7.1
Cable Terminals (Generators etc.) B 22 7.1
Storage Batteries B 23 14.3
Insulated Wire and Cable B 33 14.3
PARTS & FITTINGS
Screw Threads C 1 86
Screws, Bolts & Nuts C 2 86
Lock-Washers C 5 93
Taper-Pipe-Threads C 6a 93
Cotter-Pins C 7 93
Rod-Ends C 8 50
Rod-End Pins C 10 43
Taper Fittings C 14 35.7
Four-Spline Fittings C 16 21.5
Six-Spline Fittings C 18 43
Ten-Spline Fittings C 20 7.1
Annular Ball-Bearings C 26 86
Double-Row Ball-Bearings C 31 35.7
Angular Contact Ball-Bearings C 33 14.3
Thrust Ball-Bearings C 35 7.1
Roller-Bearings C 43 28.5
Fuel Vacuum-Tanks C 45 14.3
Pipe Fittings C 46 86
Carbureter Inlakes C 47a 28.5
Rubber Hose & Clamps C 51 57
Flexible Steel-Conduit C 52 14.3
Flexible Metal Tubing C 54 14.3
Ball & Socket Joints C 54 43
Oil & Grease Cups C 57 71.4
Lubricator Cups C 57 7.1
Drain-Cocks C 57 71.4
Tank & Radiator Caps C 88 7.1
MATERIALS
Iron & Steel Specifications D 1 86
Cold Drawn Steel Tubing D 47 50
Steel Bands & Strips D 48 28.5
Non-Ferrous Metal Specifications D 49 71.4
CHAINS
Silent Chains E 2 21.5
Roller Chains E 3 35.7
WHEELS
Rims, Cleats & Lugs for Wheels F 6 21.5
SPRINGS
Spring Rebound Clips, Spacers & Bolts H 3 14.3
Spring Center Bolts H 4 14.3
Wrapped Spring Eyes H 4 7.1
Spring Eye Bushing & Bolt Tolerances H 5 21.5
Width of Spring-Ends H*6 21.5
Frame Brackets for Springs H 6 14.3
Spring Specifications H 10 14.3
GENERAL
Tractor Specifications K 34 43
Drawbar Height K 40 71.4
Plowing Speeds K 40 43
Belts & Pulleys K 40 79
Belt Speeds K 40 79

CHART SHOWING THE RELATIVE NUMBER OF TRACTOR BUILDERS USING THE SEVENTY S. A. E. STANDARDS APPLICABLE TO TRACTOR CONSTRUCTION

Methods of Machine Tool Design

Second Article—Making a Schedule for a Machine to Be Designed—Checking Each Step in the Design Before Proceeding

BY A. L. DE LEEUW

THE first step in the design of a machine tool is to go carefully over its requirements and make a schedule. In the case of a commercial machine this schedule takes the form of a set of specifications. In the case of a special machine it takes the form of a schedule of consecutive operations to be performed by or with the machine.

Taking for example the machine for finishing the part shown in Fig. 1, and which has been analyzed to a certain extent, the schedule should be something like this:

(1) Chuck piece.
(2) Mill top and pass cutter completely over work, bringing the cutter slide against a stop.
(3) Drill three holes.
(4) Return drills to starting position.
(5) Return cutter slide to starting position.
(6) Loosen clamp and remove piece.

Select a proper arrangement for each of the functions. In this case there can be but little doubt. We may not be sure as to the detail arrangement of the drill spindles, but we *do* know that drill heads are needed for the drilling operation, and a vertical spindle for milling (making a note that we will investigate the horizontal milling spindles later on). Our machine, then, consists of:

(1) Combined mill and drill head.
(2) Drill heads.
(3) Means for clamping.
(4) Mechanism for driving.
(5) Mechanism for feeding.
(6) Framework for supporting these items.

We now make a sketch of the arrangement like that in Fig. 4.

We then analyze each of these elements as far as we can without getting into interference with another element. It seems at first glance that the means for clamping the piece can be arranged without such interference.

As this is a special machine and special machines are not made except as a matter of economy, we will naturally develop some system of clamping which requires a minimum of time and of effort on the part of the operator.

One single movement for the purpose of clamping should be our ideal. If we do not succeed with this, then we should try two or three. We assume that the bottom and sides have been milled so that it will be possible to push the piece with its gage points against two stops. This locates the piece. Fig. 5 shows a tentative arrangement of the clamps.

A and *A* are the clamps which are parts of bell cranks, fulcrumed on *B* and *B*. The long arms *C* and *C* are operated by the toggles D_1 and D_2. The foot lever *E*, fulcrumed on *F*, operates these toggles.

Having this first conception of the clamping mechanism we check it up to see if it will act properly, and find right away that depressing *E* will move D_1 to the right and D_2 also to the right, so that one clamp would close and the other open. This brings before us the necessity of moving the point *G* in a vertical line. We can do this in various ways: For instance, by a rack guided in a vertical direction and moved by a pinion or gear sector, centered on the fulcrum of the foot lever. However, should we do so, both levers *C* would get an equal amount of movement and, as the clamps bear on rough surfaces, only one of them would act. To overcome this, in other words, to equalize the clamps, we introduce link *H* and place the foot lever in position *I*. This will effectively equalize the pressure of the two clamps *A* and *A*. We now check the mechanism to see if there remains anything needing attention. We notice that the point *G* must never get above the lower joint of lever *C-C*. In other words, the toggle must never get over the center; and, as the amount of movement is rather uncertain, due to the fact that the clamps bear on rough surfaces, it may well be that the point *G* remains quite low when the clamps are down. If this should happen, there would be nothing to keep the clamps from opening.

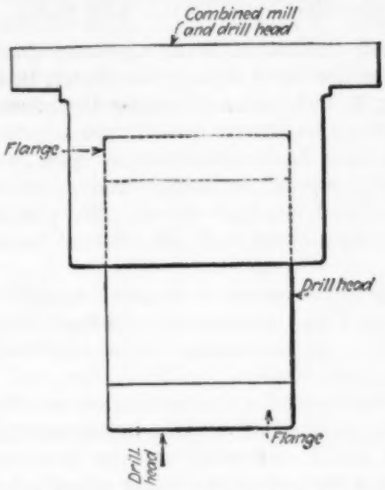

FIG. 4. SKETCH OF MACHINE ELEMENTS

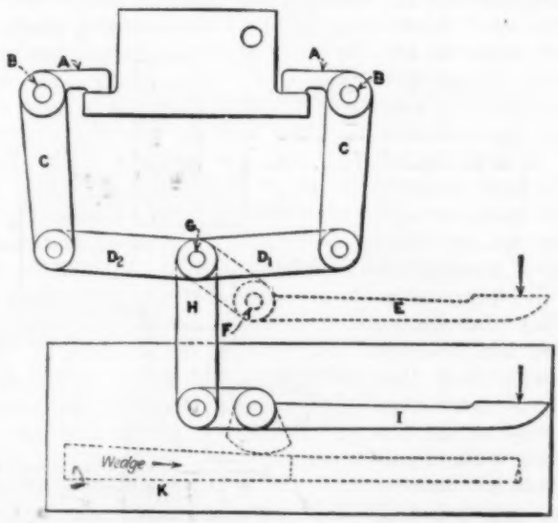

FIG. 5. SKETCH OF CLAMPING DEVICE

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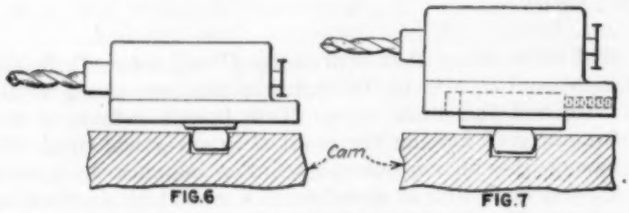
Our next problem, then, is to make some provision for holding the clamps after the foot is removed from the foot lever. This could be accomplished in a number of ways. As a first attempt we will provide a wedge *K* bearing against a projection of foot lever *I*. The wedge *K* will be moved by means of a hand lever, so that the



FIGS. 6 AND 7. ARRANGEMENT OF DRILL AND SLIDE

clamping operation will consist of bringing down foot lever *I* and then pulling the hand lever. We sketch this out, as shown in Fig. 5, but, when checking it up, we find that the wedge placed as shown would have a tendency to push the foot lever back again and so open the clamps. We therefore reverse the wedge and operate it in the reverse direction from that shown. We would naturally correct our sketch, but will not show it here to save space.

The important thing to remember is to check up carefully each new step. As this checking up is perhaps the most frequent operation in the design of a machine, a few extra words may be timely.

In checking up the function of a mechanism we should let the operation of the various parts pass in our minds at a very low rate of speed, and imagine them to stop the moment a slightly different action takes place. In our case of the wedge, we would imagine it to be so far to the left that it does not yet touch the projection of foot lever *I*. We move it slowly to the right until it touches this projection. We move it a little bit further to the right, keeping our eye on this point of contact. We will watch what will happen and see, of course, that, there being considerable friction between wedge and projection, the wedge is liable to take the projection with it, and we notice that this will move the foot lever in the direction for opening the clamps.

This slow checking up of the functions of a machine should never be forgotten. It may take considerable time where the mechanism is complicated, but it pays to do it. There would be a great many other ways of accomplishing the purpose of holding the clamps in position. We will always find that there is more than one way of accomplishing whatever purpose we have in mind, and it is well to sketch out, or at least keep in mind, a few varieties and compare them after we have each one worked out to a point where comparison becomes possible. However, for the purpose of this treatise, and considering the amount of space available for it, we will confine ourselves to one single example.

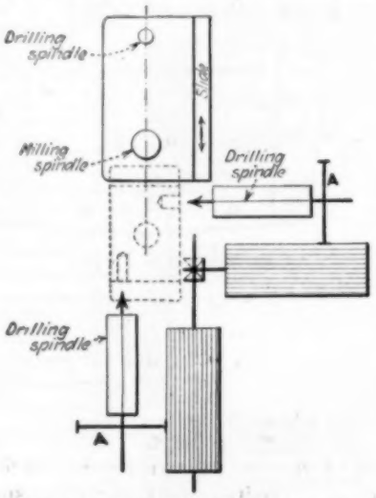


FIG. 8. PROGRESS DIAGRAM OF MECHANISM

The fact that we had to do something to keep the clamps in their working position brings up to us the desirability of finding some construction which would not require such a secondary operation; something which in itself would make the unclamping impossible. Of course, the only way which would be absolutely certain would be to keep our foot on the treadle with the full pressure exerted for the clamping operation. This, however, would be uncomfortable for the operator and would prevent him from moving away from his working position. However, any other means which will keep the link *H* under its initial pressure will be equally good and we naturally think of an air cylinder or hydraulic cylinder or of some other mechanical means for exerting pressure to take the place of the foot lever. And so we might remove that portion which is blocked out in the sketch and substitute for it a double-acting air cylinder of which the piston rod is connected to link *H*. What this example shows so far is the possibility of working out a more or less complicated problem without ever considering more than one thing at a time. And this is perhaps the most essential point in the method of designing machinery. So far we have paid no attention to sizes, proportions, locations, or anything else which would make our mechanism directly applicable to the machine we designed, but we will not go into this matter just now, rather taking up the other elements of the machine and bringing them to the same point of completion.

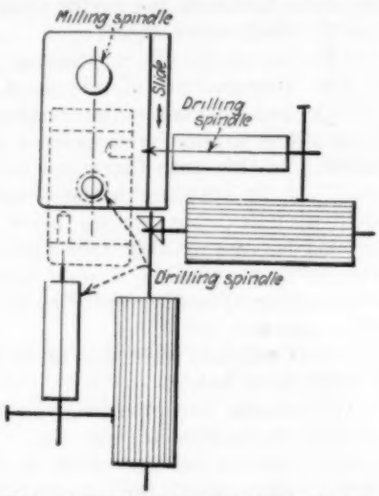


FIG. 9. CORRECTED DIAGRAM OF MECHANISM

Analyzing the requirements of the drill heads we find that each head must be capable of drilling one hole to a certain depth and return, and further that each head must be adjustable to make up for various lengths of drills. As only one size hole needs to be drilled, only one speed is required, and though the speeds of the two drill heads may be different yet both heads may be similar in construction and possibly may be exactly alike. If, for instance, one hole should be $\frac{7}{8}$ in. and the other 1 in., we would probably have to make two different sizes of drill heads; but if the one hole were $\frac{7}{8}$ in. and the other $\frac{1}{4}$ in., there would not seem to be any reason why we should not make both heads the same. Assuming that in our case the two holes are of near enough equal size to permit of the use of the same drill head, we will now investigate the construction of this head.

We will put the drill spindle in a simple slide and key a gear to the end of the spindle for its drive. As the depth of hole to be drilled is always the same we do not need a complicated mechanism for feeding it in to the required depth but can use a simple cam, and we will provide this slide with a roller upon which a cam can work. See Fig. 6.

This arrangement seems to fulfill all the requirements

of the drill head, except that it has no adjustment for various lengths of drills. There are quite a number of ways in which we could take care of this adjustment. For instance, by putting the drill in a chuck or holder which is adjustable in the spindle. Such a construction is often used. Another construction for the same purpose would be to put the drill spindle in a sleeve and make the sleeve adjustable in a longitudinal direction. Still another construction is to make the position of the cam roller adjustable in the drill head. We will assume that conditions are such as to make the last mentioned construction the most attractive. Fig. 7 is a sketch which we will make of this selected construction. A roller is attached to some piece or slide which is adjustable by means of a screw and, of course, must be clamped in the drill head. We are not at all sure yet as to what exact form we will give to this slide, and this is not yet necessary. It is better not to have very definite ideas as to the form and details of a construction too early.

The drill head as we now have it meets all conditions. It has a spindle, a drive for the spindle, it is guided in a slide—not shown in the sketch—there is a cam and roller for the feed, and there is means for adjustment.

Analysis of Construction

We should now analyze this construction and see if we are liable to get into trouble at any point. It is easy to carry out all the details of the construction, but there seems to be one point where we have missed connection. We have a driving gear at the end of the spindle but we have no means of operating it. This seems, then, to be the next item of which we should take care. And so we produce the sketch in Fig. 8 which shows the two drill heads in diagrammatic form and also the double drilling and milling head. Realizing that the gear *A* moves in the direction of the spindle, either on account of the feed or on account of the adjustment, we see that we must drive it either from a sliding gear or from a long pinion. Which of these two we will prefer will probably depend on the amount of movement. If this amount is relatively small the long pinion will be a simple construction, but if it is great we will probably have to use the sliding gear construction. We will make our sketch with the long pinion and make a mental note of the alternative construction.

Seeing the relative position of the two drill heads makes us automatically think of the way of driving these two heads from one source, and the construction shown in the diagram looks natural to us, though we realize that the location of the parts may make it necessary to modify this construction somewhat.

We now check this latest addition to the construction of the machine. If the two drills are to run at the same speed we will be able to use the same gearing on both drill heads and miter gears at the junction. If there is a relatively small difference in their speeds we will make up this difference by substituting bevel gears for miters, and as we have assumed that the two drills are of very nearly the same size, we do not need to look further into this matter. We have taken care of the common drive and the relative speeds. We must now check up the directions. We notice that if one of the two drill spindles turns in a right-hand direction the other drill spindle will turn left-hand which, of course, is not permissible. We can correct this by adding an idler to one of the two drill heads, but as we wish to make the drill head serve in both cases this solution is not desirable. Another way of meeting the problem is to change the relative location of the bevel gears as indicated by the dotted lines.

We must now consider the combined milling and drilling head. Our first conception of this device is shown in Fig. 8. The direction of the slide is such that we can use a small cutter. If we had placed this combination opposite the other drill head a larger cutter would have been necessary. Of course, our first consideration is to use such a cutter as will produce the piece in the least amount of time. At a first glance it might seem that the larger cutter will give this result, because the distance to be traveled is less. However, it is not possible to say with certainty which way will give the greatest economy of time unless we know the dimensions of the piece we mill. For the sake of clearing this matter up somewhat we will assume that the dimensions of our piece are 2 x 4 in., and that we will use a 2½-in. cutter going the long way and a 5-in. cutter the short way.

If we use a 2½-in. cutter and we must traverse a piece 4 in. long (and being a rough casting it may be a shade longer), we should allow for the length of the piece plus the diameter of the cutter and a little for clearance—say altogether 6¾ in., and if we should mill the other way, 2 in. plus 5 in.—say 7¼ in. It is obvious that feeding in the direction of the length of the piece is more economical because we have a smaller cutter traveling a shorter distance.

The writer, being in possession of all the facts, may just as well divulge the secret now; it will save him reopening this subject later. We will find that it is not necessary to have the cutter travel farther than needed to bring its center over the far edge of the piece. In that case the small cutter would travel 5½ in. and the large cutter 4¾ in. On the other hand, the speed of the small cutter, meaning the number of revolutions per minute, may be twice as much as that of the large cutter; and as the length to be traversed by the small cutter is not nearly twice as much as that to be traversed by the large one, it is evident that the arrangement as shown on the sketch is the more economical.

We have arbitrarily assumed, at least in the sketch, that the milling spindle leads. So far we have no reason to take for granted that this will make the best arrangement, and therefore, before we look into the details of either the milling or the drilling spindle, we will determine what is the most economical way of placing them.

If the relation is such as shown in Fig. 8 the milling spindle must advance not less than 6¾ in. before the drill spindle can begin to work, because we would not dare to leave the milling cutter over the work while the drill spindle is drilling. This also means that we must feed not less than 6¾ in. Anything we can do to reduce this amount of feed will speed up the operation and will make a number of the elements of the machine, such as cams, of smaller dimensions. If, on the other hand, we should make the drill spindle the leading one, and if the position of the rest of the combination slide were such that the drill spindle is immediately over the hole to be drilled, as shown in Fig. 9, the amount of feed we would need would be the radius of the cutter plus the length of the piece. After milling, the slide would return to its original position and the drill spindle would begin to work. This amount would be 5½ in. which is considerably better than 6¾ in. For this reason we will change the proposed construction to that shown in Fig. 9.

(*Continued in next week's issue*)

Economic Aspects of Standardization

Mass Production and High Wages Impossible Without Some Standardization—Technical Excellence of One Standard May Be Out-weighed by Economic Value of Another

By E. F. DuBRUL

SINCE the discovery of the great inventions and the beginning of the industrial revolution that was going on about the time of the American Revolution, modern industrial processes have developed more and more through the division of labor. The individual workman is no longer producing the whole product that the consumer finally gets; but almost every article that is used anywhere is the work of many hands.

In the United States, with relatively high labor costs, mechanical processes have developed to the fullest extent the general system known as "mass production." This means that industries as a whole are not self-sufficient, but are interdependent, depending for their supply of materials and parts on some elements, and for their demand on entirely different elements of our people. This very fact requires standardization, so that the buyer of supplies can know when he buys from several sources, as he should for his own protection, that the pieces bought from the different sources will equally serve his purposes; that means that they are standard, as far as he is concerned.

But other reasons exist why the same pieces should and do become standard for their users. These reasons also are reasons of cost, which, by mass production, is greatly reduced, as every one knows. Cheap production depends on quantity production. Quantity production makes possible the gathering together of engineering and supervisory talent and it better organizes and directs a given body of men. It also permits better training of men in certain operations, and the raising of the standard of skill by specialization. In addition, it permits the production of goods of better quality, due to the fact that besides making the individual workman more skillful on specialized operations, it permits the design and production of machinery and appliances into which is fixed, once for all, the skill of the most expert workmen. This principle is known as the transference of skill and the transference of thought from men to machines. The automatic screw machine is of course a leading example of the embodiment of this principle.

Commercially, in addition to cheapness, it makes for a wider market; and there is the element of prompt delivery. The manufacturer of a standardized product can better afford to keep in stock large quantities of such product than he could products that are not standardized and whose demand may therefore be entirely eliminated by some change in taste or desire. This risk must form an additional element in the cost of the manufacture of goods that are not standardized.

Mass production of standardized parts not only reduces the direct cost, but the overhead costs as well, such as engineering and designing of the special tools and machinery that are used to make the standardized product. It reduces the cost per unit of office help and supervision all along the line; and this, in turn, becomes reflected in the lower price. Standardization reduces the amount of capital required to operate the business using standardized parts, because one sure effect of standardization is to reduce a large variety of pieces to a few fixed kinds.

In one industry, where ninety-six different kinds of certain parts were found to be produced, these have been reduced to nine. The producers of the ninety-six no longer have to have the special appliances, no longer have to carry stocks and care for those stocks at great expense for storeroom labor in order to supply demands that, in many cases, were mere whims of the designers of the machines in which these parts were used. The nine standard parts could be produced in larger quantities and the prices of the nine standard parts soon fell to one-third of the former prices charged for any one of the ninety-six similar parts before standardization. Another effect is that increased accuracy of the standardized parts is obtainable with less expense than the inaccuracy of the unstandardized parts. This reason again lies in the principle of the transference of skill, because more accurate duplication and better interchangeability can be obtained, the larger the quantity to be produced; this again being due to the fact that with the larger quantity to be made greater investment is justified, in special machinery of a better character, such as is needed to produce the better accuracy.

The agricultural machinery manufacturers, in surveying their own situation, found many kinds of cast-iron seats used on agricultural implements. The mere disclosure of this situation was sufficient to demonstrate that it should be changed. This situation had grown

STANDARDIZATION and simplification are the order of the day. Long a desirable development from the competitive scramble where differences between various allied products scarcely merited the name of distinctions, they are coming to be recognized as essential to our existence.

It will be the engineer's job to suggest the models and types on which to concentrate but the economist's task to select the best from the viewpoint of securing the greatest good for the greatest number. Many pet preferences must be swallowed or compromised before the desired end is achieved, but if it is possible for the statesmen of the great powers to agree on such points as distinguished the recent disarmament conference, it should certainly be possible for manufacturers and users of paving bricks or machine tools to get together on matters of far less import.

so that even in the same company, a mowing machine had one kind of seat, a hay tedder, that was used a few hours afterwards, had a different seat, and the hay rake had still a different one. Perhaps even now, the manufacture of seats may be taken out of the agricultural implement concern's own foundry and someone will specialize on those, selling the product to all manufacturers of agricultural implements, at a price cheaper than they could afford to make them themselves. The adoption of standardized usable parts on different machines, as in this case, greatly reduces the number and kinds of parts within the industry. The more standards are adopted that fit diverse industries, the more will the benefit of standardization percolate through our whole industrial system.

Standardization makes for interchangeability of repair parts and better service to the consumer. The automobile industry has demonstrated this in many ways. The automobile supply house now carries standard parts of many kinds that, with a very few sizes, enables the user of automobiles to procure certain repairs almost anywhere. If the same methods were adopted, for instance, in the agricultural implement line, much good would result to farmers. Instead of waiting for some part to come from the factory, because it is special to the extent of a slight variation in dimension from another part, the hardware store could act as a service station for all sorts of implements and carry stocks of standardized parts, as the automobile supply houses do.

The determination of standards is a matter that requires the best thought, because as standards are adopted and come into common use a change becomes exceedingly difficult. Therefore, before adoption, careful study should be made of the proposed standards that they may be the best that it is possible to obtain for the purpose intended. This requires, in some cases, quite extensive research on seemingly simple things. At times it requires a compromise, because situations are found that, while one thing is the best, another thing somewhat less desirable has come into such general use that the cost of change would be prohibitive and would greatly exceed any benefit that the better standard would present over the poorer one. It is a matter of relative worth of one to the other, balanced against the cost of the change.

Arguments Against Standardization

At times some men raise the question that standardization is disadvantageous because standardization fixes practice in certain grooves and this prevents progress because the designer of the improved machine, or what not, is closely confined to the adopted standards.

This argument is very likely to be over-done. If any material progress is possible by deviation from a previously adopted standard, the newer and better standard would and should displace the older and less adequate. The passion for self-expression in design is not always true progress. Slight variations are frequently confused with improvement. They look large in the eyes of the salesman who wants a "talking point," to show the ill-informed buyer wherein his machine is different from the others; but the same salesmen will not be able to demonstrate wherein his mere variation is any better than others. Such variation is, of course, not true progress. Even so, true progress, unless very radical and decidedly advanced, may cost too much in obsolescence of fairly adequate standard devices, including obsolescence of all the special machinery and appliances used to produce the previous standard articles. On the whole, the general experience of industry does not prove that the benefit of so-called progress is sufficient to overcome the benefit gained by the reduction in cost of standardized products through mass production.

Standardization in Machine Tools

As all interested in the machine-tool industry, either as users or producers, consider the questions of standardization, they will find many things in which standardization is desired.

First, there is the elimination of unnecessary sizes. It is said that lathes, for instance, can be bought from some maker or other in any interval of swing from 9 to 36 in., progressing by 1-in. steps. Certainly, no good purpose can be served by any such variety. This variety has come about through competitive conditions. Some buyers perhaps thought they wanted a lathe of 19-in. swing because an 18-in. was just a trifle too small for their work, and some lathe builder, hungry for orders, stood ready to supply the 19-in. machine at a few dollars less than his previous standard 20-in. machine. So another size was added to his line. Or else there was some new competitor who thought to slip between the previously established intervals and gain trade from both, and rather than make two designs, one for 18-in. and one for 20-in. swing, made only one design for 19-in. Then the old competitor perhaps raised his head and tailstocks only 1 in. and he too offered his 18-in. machine to swing 19 in. So it went, until today the usual designations of lathes mean very little. Eighteen-inch lathes do not generally swing 18 in., but considerably more. This makes the problem of purchasing that much more complicated. It does not affect the small jobbing shop which can use a second-hand lathe, many years old. The difference in price between an 18- and a 22-in. lathe would be very slight on the second-hand market. But it does prevent the standardization of equipment in manufacturing shops, working themselves on mass production.

We saw the results of this during the war. Unable to get machines of the same make to the fullest extent required in a given shop, the buyer had to take the nearest thing he could get, and what he finally got was a collection that, for variety of sizes, might be the fair beginnings of a museum. This one element of variation in size could have been largely avoided had recognized standard sizes been accepted and adopted.

So it went through many other lines of machine tools. No study had ever been made to determine the actual preference of users as disclosed by sales. If such information had been available, the machine-tool industry, in co-operation with the users, could have laid down certain standard sizes in as great variety as were economically demanded; and these, when accepted as standard sizes, would have controlled that situation. Today, the demands of users can be made manifest through the American Engineering Standards Committee. After investigation that will disclose what the user has preferred to purchase, and also after investigation of what variation in sizes is actually desirable, the unnecessary sizes can be discouraged, much to the benefit of both producers and users. As a class, the users eventually pay for all the waste that arises from unnecessary multiplication of sizes. If they did not, the producers could not long exist. If this waste is saved,

its amount can be diverted to the production of other commodities.

American industry can retain its relatively high wages only with relatively high production per dollar of wages. This, in turn, can be obtained only through greater standardization to make mass production possible. Therefore, standardization has a decided interest for the consuming elements, who, in number and in amount of wages, form our greatest market.

If the product of the world is increased, the same percentages of the increased product going to wages and capital and management means a greater amount for all. We are like a family who has an apple tree in the yard of its house. Given the same climatic conditions, that apple tree will produce more and more apples as it grows older and larger, and each member of the family will have more apples, on whatever basis of division the family has adopted. But if the apple tree is stunted in its growth, or disease attacks it, or the frost in some years kills the crop, then the members of the family each have fewer apples.

Standardization is one way to increase the industrial crop of products. We cannot get more products for consumption, unless the world produces more products. If less effort were put to fighting about the division of a small crop of industrial products, and more were put to producing a larger crop, the world would certainly be better off; and each member of the world family would have more goods to consume. Standardization is one way of increasing the crop, and a very effective way, as has been shown wherever it was tried.

Putting Industrial Cripples Back to Work

BY DR. W. GILMAN THOMPSON

Railroad men, both executives and trainmen, are viewing with increasing interest and approval the development of means for the rehabilitation of industrial casualties and treatment of industrial injuries so as to put the man back on his job again with the least possible loss to himself and his industry.

Industrial hazards naturally have been reduced materially by safety devices and compensation laws that make safeguarding of life and limb compulsory. But the volume of non-fatal accidents among employees of railroads is tremendous nevertheless, and will continue to be. Having done nearly all that intelligence can suggest to reduce accident frequency the condition still persists that when an injured man is discharged from a hospital with his wound healed or his fracture mended he is in many cases far from able to work again. In some cases he will never regain use of hand or foot or nervous control sufficient to go back to his trade.

This situation, so serious industrially as well as from the human side, is being met by the Reconstruction Hospital, 100th Street and Central Park West, New York City, in a way that is arousing national interest.

As an example of what industry has to gain from such a hospital and its complete equipment for physiotherapy, there is the case of an employee of the New York Central R.R. who fell and broke both bones in one of his legs. He was treated at a general hospital and the bones set properly. But after four and a half months' treatment he was still wearing the plaster cast, unable to put his foot to the ground. The bones had knit perfectly and there the usual hospital treatment ended. The man went to the Reconstruction Hospital and received a thorough diagnosis by the complete staff of specialists. It was discovered that the trouble was not in the broken bones but in the lost functions of the stiffened joints of ankle and knee. He was given treatment, electrical and massage, and on the re-educational machines in the gymnasium. In ten days he walked; in two weeks he left on foot with his smiling wife; inside of six weeks he was back at work.

An employee of the Ontario & Western R.R. is being treated. He got his hand caught in a machine and it was mangled badly. The general hospital sewed up the cuts, bound his hand and arm to his side and gave him treatment that cured his hand in eight months. They were then through. But the man was left with a crooked, distorted and useless hand, and from long disuse, an arm and shoulder incapable of movement and very painful. He has been receiving re-educational treatment at the Reconstruction Hospital for two months now. His shoulder is limber enough so that he can throw a ball, which in fact is one of his exercises. All but one finger on his hand are under his control again. Without the rehabilitation treatment with its massage, electrical treatment and mechanical exercises on machines peculiarly fitted for the purpose, he might never have regained the use of his hand and his shoulder would have grown worse instead of better.

This sort of treatment, an outgrowth of the reconstruction needs of the armies during the war, demands a special sort of hospital with electro-therapy and hydro-therapy equipment not possessed by many general hospitals, as well as a staff of surgeons and diagnosticians peculiarly fitted for their work. But in the spread of such hospitals lies a new hope for men engaged in hazardous industries and a new opportunity for the industries themselves to bring their trained and trusted employees back again after accidents.

The aim of the directors of the Reconstruction Hospital is to make it an institution upon which other similar hospitals all over the country can be modeled, and to give instruction to students and graduates in the modern science of industrial medicine and surgery as well as training nurses for service in industrial plants.

A Dual Reduction Rear Axle

Interesting Cutting-off, Drilling, Boring and Milling Methods on a Forged Axle—Fixtures Which Facilitate Easy Handling

BY FRED H. COLVIN
Editor, AMERICAN MACHINIST

THE making of the dual reduction axle for the Mack truck, involves some interesting machining operations, as will be seen from the following illustrations. These axles are made at the Allentown, Pa., plant of the International Motor Company, this being a new plant and one which is modern in every particular, both as to building and equipment.

The first operation is sawing the forgings to length

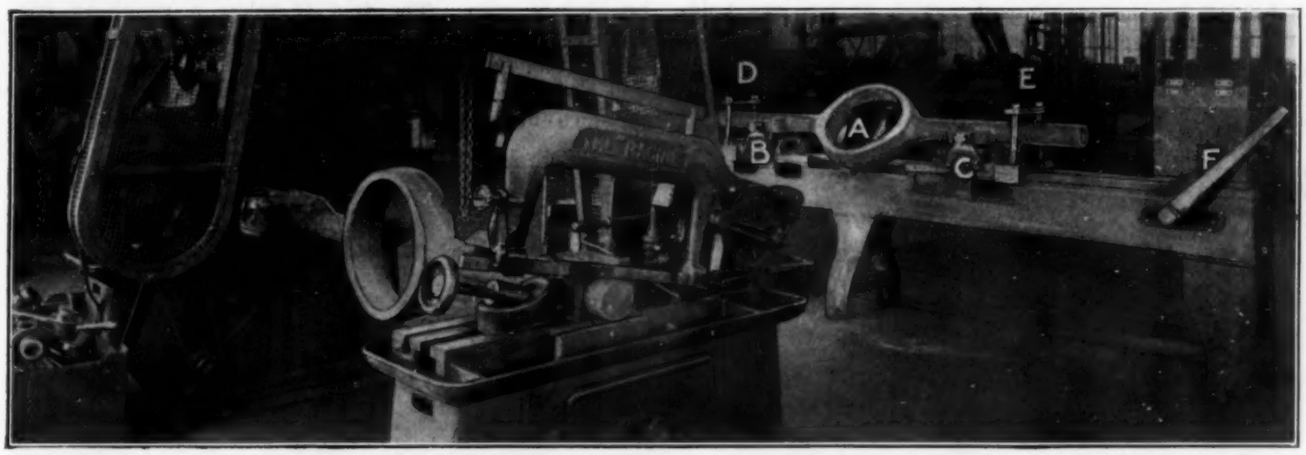
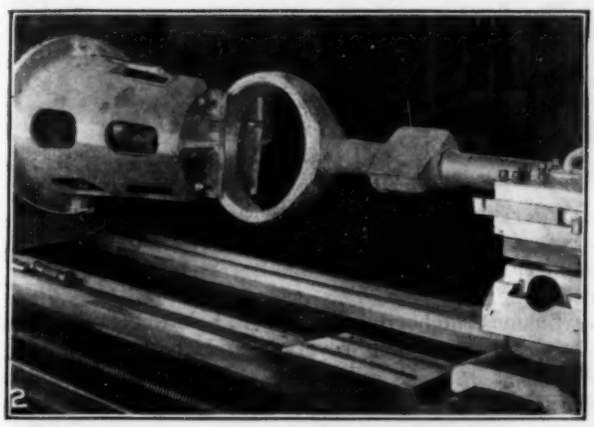


FIG. 1. CUTTING OFF AND CENTERING AXLES



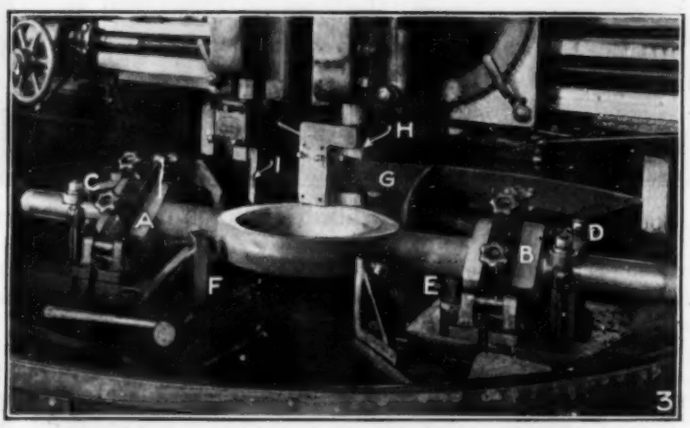


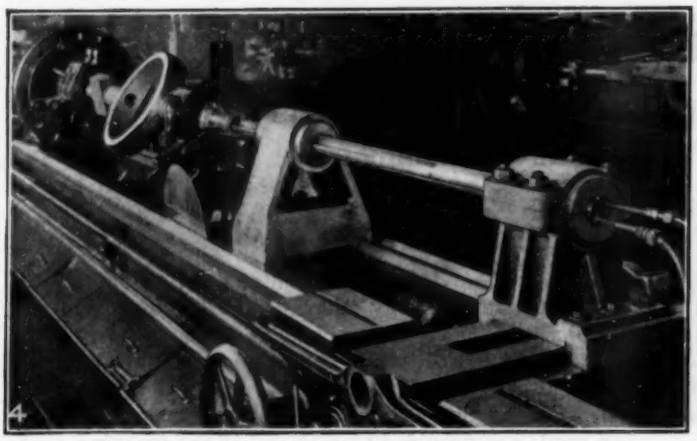
FIG. 2. ROUGH-TURNING THE ENDS. FIG. 3. ROUGH-BORING AND FACING THE BANJO

(70¾ in.) on the two Racine power hacksaws, shown in the foreground of Fig. 1. These hacksaws are located at the proper distance apart so that both ends of the axle can be sawed at the same time with a minimum of attention on the part of the operator. A "Little David" air hoist, mounted on a light overhead traveling crane which serves this and the following operation, makes it easy to handle the forgings from the floor to the cutting off machine and from here to the centering lathe shown in the rear. In both of these operations the axles are located by the spring pads which are forged integral with the axle itself and which are located at an angle with the center opening or banjo if we use the terminology adopted in the shop.

In locating the axle for centering, the banjo rests on the inclined bar *A*, while the spring pads are centered and held at *B* and *C*. The screws *D* and *E* prevent the axle shifting during the centering operation. Centering heads are provided at each end of the machine, these being belt driven and moved to the work by the handle *F*. This is a special machine and the holding fixtures have been so designed as to check the forging dimensions so as to insure cleaning up at all points.

The axles then go to lathes equipped with special chucks, as shown in Fig. 2, which rough-turn the ends to 3¼ in. diameter, a tolerance of 0.002 in. being maintained on this operation. This turns the axle between centers and at the same time supports the banjo and utilizes it for driving the axle during the rough-turning.

The rough-boring and facing of the banjo follows, this being performed on a specially equipped Bullard boring mill as shown in Fig. 3. Here again, the axle



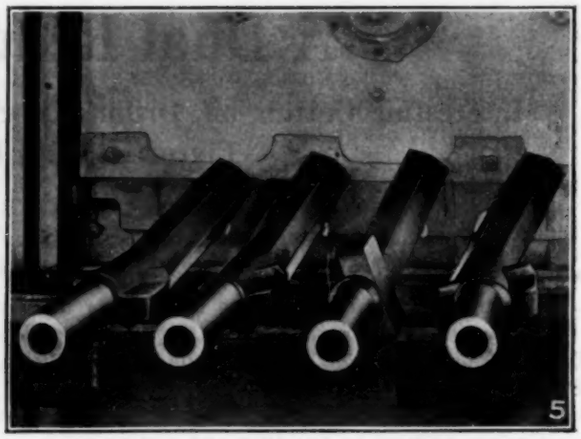
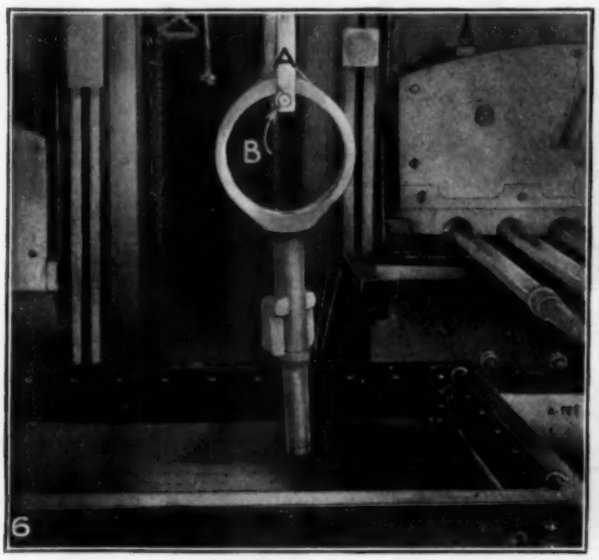


FIG. 4. DRILLING THE ENDS. FIG. 5. HEAT-TREATING THE ENDS

is located by the spring pads which fit into the holding fixtures at *A* and *B*. These locate the pads at the proper angle while clamps *C* and *D* center and hold the axle so that the banjo will be bored and faced square with the two ends. Supporting jacks are provided under each end, one being shown at *E*, while the banjo itself is centered and supported on the outside by four angular clamps as at *F*.

The arrangement of the tools in the two heads can be plainly seen. The tool *G* takes a roughing cut through the hole and after it has reached the proper depth it is fed sideways along the rail so that tools *G* and *H* face both sides at the same time and the correct distance apart. The tool *I* takes a smoothing cut through the bore but the finishing is left to a future operation.

Next comes the boring of a 2⅞-in. hole for the driving axle, the forging being reversed and the holes drilled



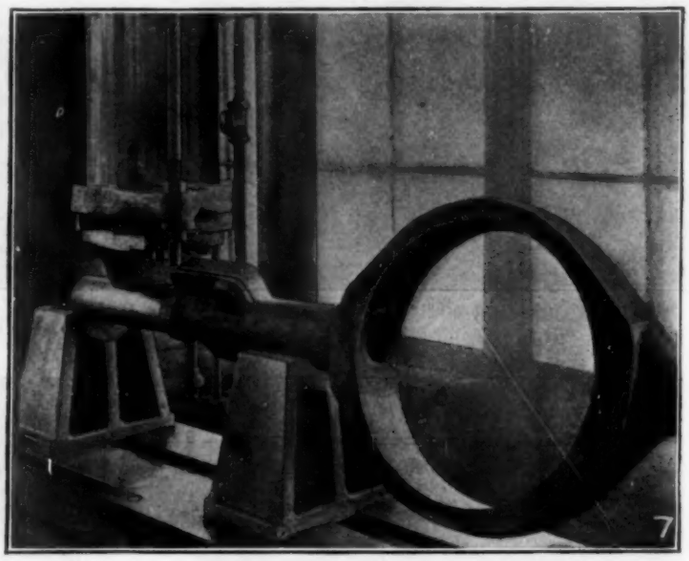
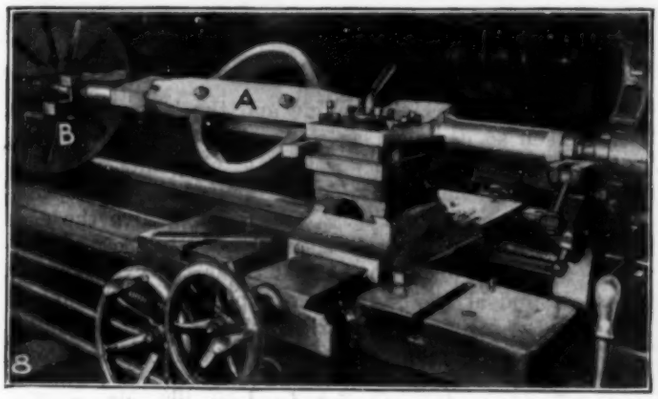


FIG. 6. THE METHOD OF QUENCHING. FIG. 7. STRAIGHTENING AFTER HEAT-TREATMENT



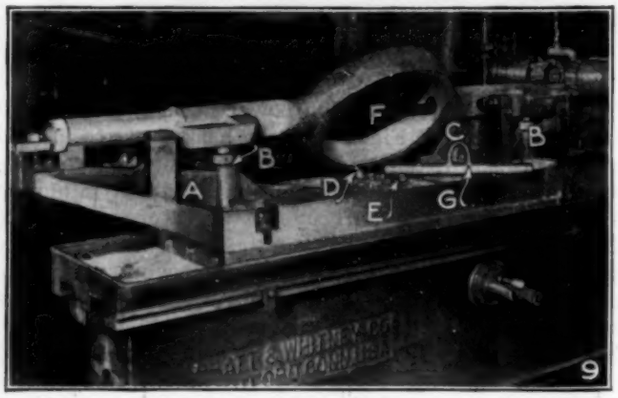


FIG. 8. FINISH-TURNING THE ENDS. FIG. 9. MILLING THE SPRING PAD

from each end. This is done on a standard 22-in. Lodge & Shipley lathe which is specially equipped with the boring bar shown, and uses a heavy oil pressure to remove the chips. A type of gun drill is used which has proved very satisfactory. It will be noted that two cross-slide and crossfeed screws have been removed to make room for the head which carries the boring tool.

Heat-Treating the Axles

The axles then go to the heat-treating department where the ends are heated in the specially equipped furnace shown in Fig. 5. The special door allows the ends of five axles to be heated at once and eventually prevents the heating of the banjo. The axles are then quenched as shown in Fig. 6, this showing the convenient method of supporting them while being dipped by means of the yoke *A* and the removable pin *B*. The axle ends are then reheated and drawn to 270 Brinell harness. Then the axles are tested for straightness and if necessary, straightened in the 150-ton hydraulic press shown in Fig. 7. The form of the bed and the substantial supporting block require no further description.

The ends of the axles are then finish-turned as shown in Fig. 8. Supplementary centers are used and it will also be noted that a special supporting clamp *A* covers the banjo and reaches to the spring pad. The two sides of the clamps are held together by through bolts in the banjo hole. The setscrews at the end aid in stiffening the whole piece and effectually preventing its springing during the turning operation. The clamp for driving is shown at *B*.

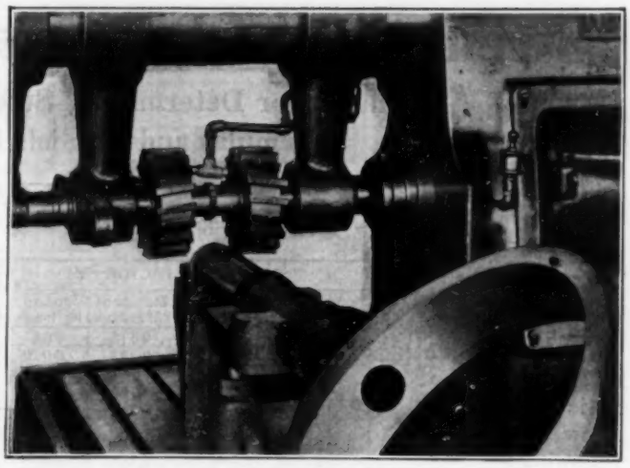
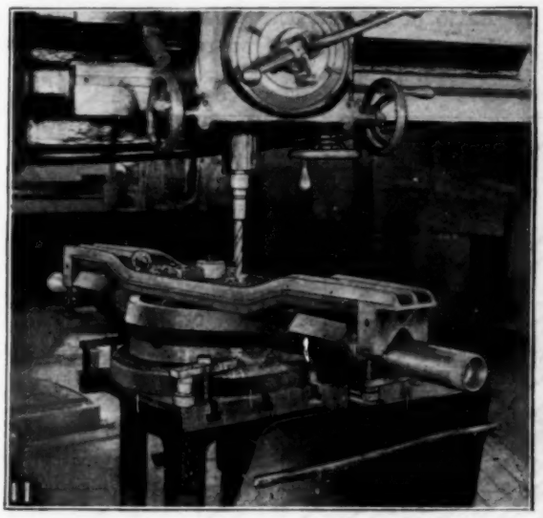


FIG. 10. MILLING THE KEYWAYS

Milling the Spring Pads

A special fixture is provided for milling the spring pads, as shown in Fig. 9, this operation being performed on a Pratt & Whitney duplex milling machine. The turned portions of the axle are supported at the ends, as at *A* and easily operated screw jacks *B* come up under the spring pad and take the downward thrust of the milling cutter. The pad is located endwise by the screw stop *C*. Stops *D* and *E* locate the angle of the banjo.

The method of handling these axles by the overhead air hoist is interesting, both from the viewpoint of convenience and facing. The lifter *E* with its projecting pins, can easily be slid into place and used in lifting the load, the pins effectually prevent any side slipping. The lifting bar can remain in the axle during the operation or can be removed at will. Another lifting bar is shown at *G* simply to show just exactly how it is made.



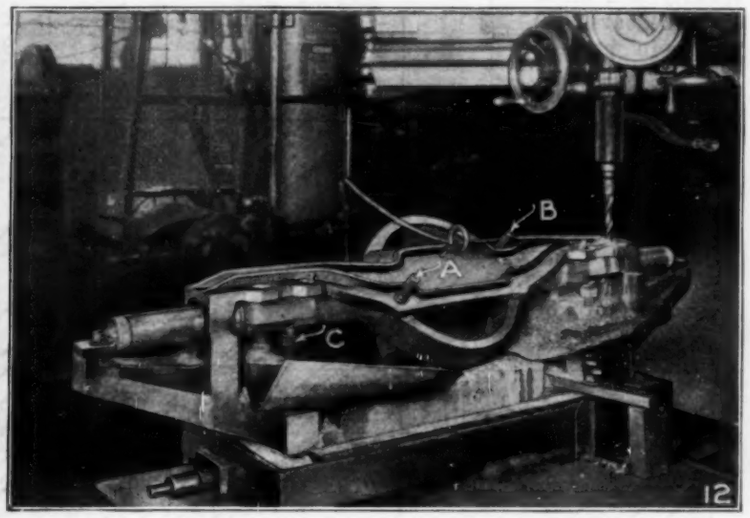


FIG. 11. DRILLING AND TAPPING BANJO HOLES. FIG. 12. DRILLING PADS FOR SPRING BOLTS

A similar fixture is also used on the No. 5 Cincinnati machine shown in Fig. 10, which is used in milling the keyways for the stop collar at the end of the axle. The large milling cutters can also be used in machining the spring pads as supplementing the other machine.

The four bolt holes are next drilled through the rim of the banjo by means of the portable fixtures shown in Fig. 11. This positions the holes lengthwise with reference to the axle shoulders and centers them by the axle ends themselves. Quick-acting clamps fasten the drilling fixture firmly in position, under the American radial drilling machine shown.

The last machining operation is shown in Fig. 12, where the spring bolt holes are being drilled through the spring pads. Here the holes are located from those previously drilled and tapped in the rim of the banjo, by the plugs *A* and *B*. Screw jacks support the spring pads so as to allow a heavy feed to be taken in the drilling operation. Then come the boring and final inspection, after which the axles are ready for assembly.

Strength and Proportion of Industrial Gears

Charts for Determining Strength of Industrial Gears—The Formulas and Symbols Used—Practical Examples

BY G. E. KATZENMEYER
R. D. Nuttall Co

TO determine the proper size and to calculate the strength of gears, it is necessary to know one of the following:

(a) Horsepower of drive and r.p.m. of shafts or velocity and diameter of gears. (b) Kilowatts consumed and r.p.m. of shafts or velocity and diameter of gears. (c) Torque in shafts in inch lb. and r.p.m.

STRENGTH FACTOR—Y			
Number of Teeth	R.D.N. 20° Involute Stub	Standard 20° Involute	Standard 14½° Involute
12	0.099	0.078	0.067
13	0.103	0.083	0.070
14	0.108	0.088	0.072
15	0.111	0.092	0.075
16	0.115	0.094	0.077
17	0.117	0.096	0.080
18	0.120	0.098	0.083
19	0.123	0.100	0.087
20	0.125	0.102	0.090
21	0.127	0.104	0.092
23	0.130	0.106	0.094
25	0.133	0.108	0.097
27	0.136	0.111	0.100
30	0.139	0.114	0.102
34	0.142	0.118	0.104
38	0.145	0.122	0.107
43	0.148	0.126	0.110
50	0.151	0.130	0.112
60	0.154	0.134	0.114
75	0.158	0.138	0.116
100	0.161	0.142	0.118
150	0.165	0.146	0.120
300	0.170	0.150	0.122
Rack	0.175	0.154	0.124

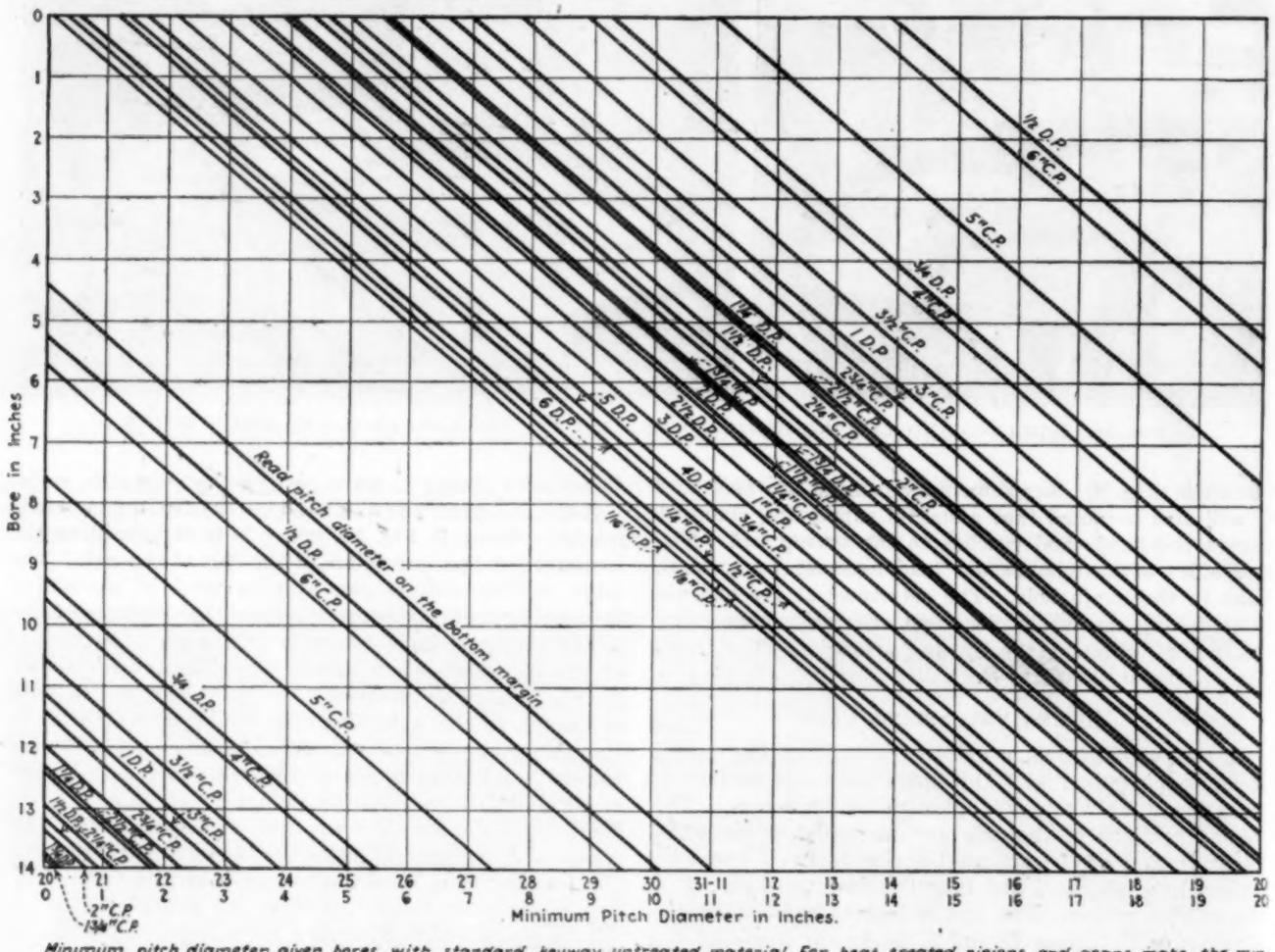
(d) Load or weight lifted, the diameter of drum, the velocity of the lift and r.p.m. of driving member (for hoists).

(e) Diameter of shaft and r.p.m.

In addition to one of the above the working condition and service should be taken into consideration.

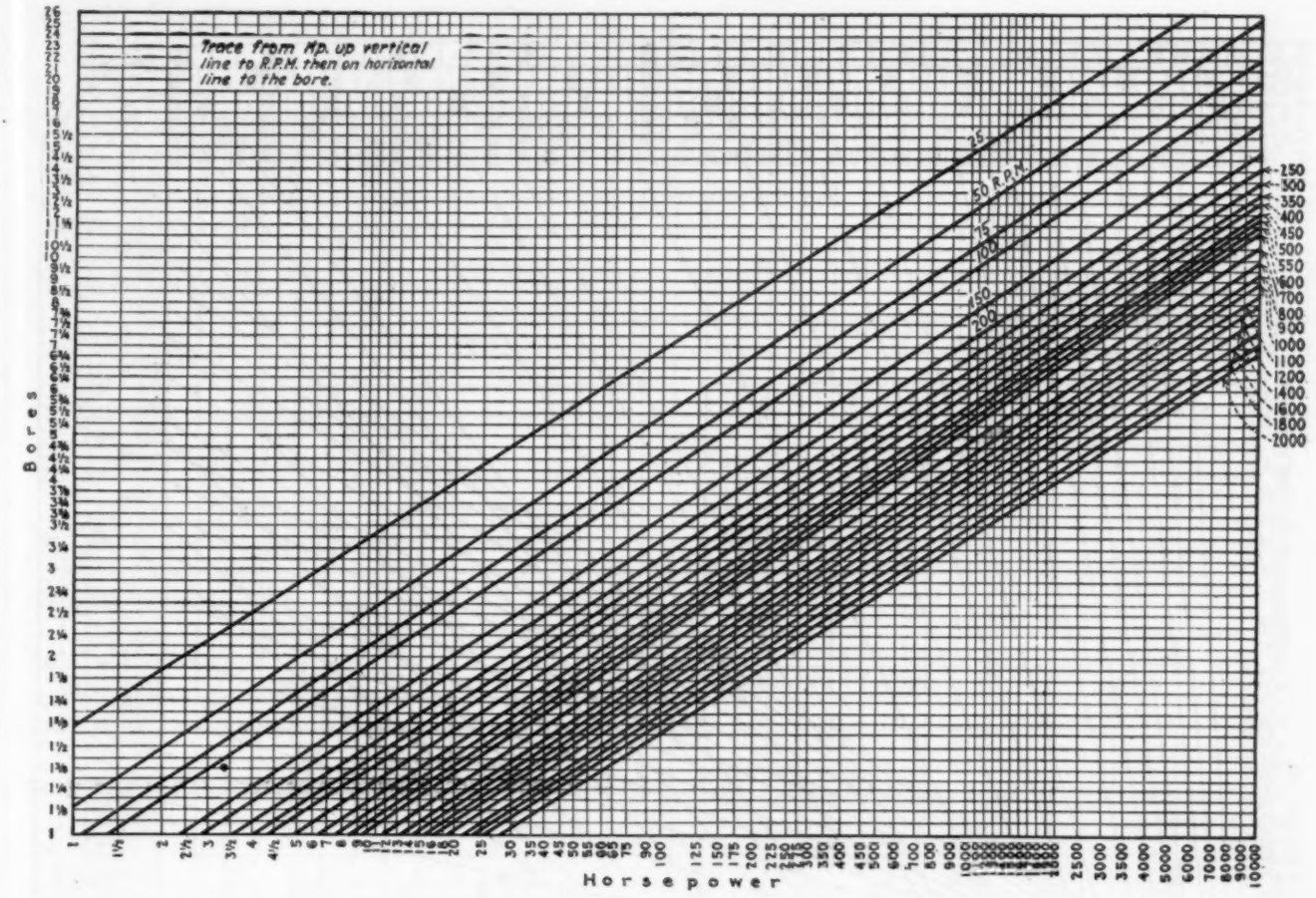
These symbols will be used in the equations which follow:

hp. = Horsepower.
W = Load at pitch line.
V = Velocity in feet per minute.
kw. = Kilowatts.
r.p.m. = Revolutions per minute.
Te = Traction effect at car wheel.
M = Miles per hour.
R = Ratio of gear to car wheel.
S = Working Stress of material from chart No. 4.



Minimum pitch diameter given bores with standard keyway, untreated material. For heat treated pinions and gears make the minimum thickness between root diameter and (bore + $\sqrt{\frac{W}{S}}$), keyway or counterbore equal to $\sqrt{\frac{Te}{S}}$ from bore trace along horizontal line to pitch, then on vertical line to minimum pitch diameter.

TABLE (ABOVE). STRENGTH FACTORS FOR LEWIS FORMULA. FIG. 2 (BELOW). CHART FOR MINIMUM PITCH DIAMETERS



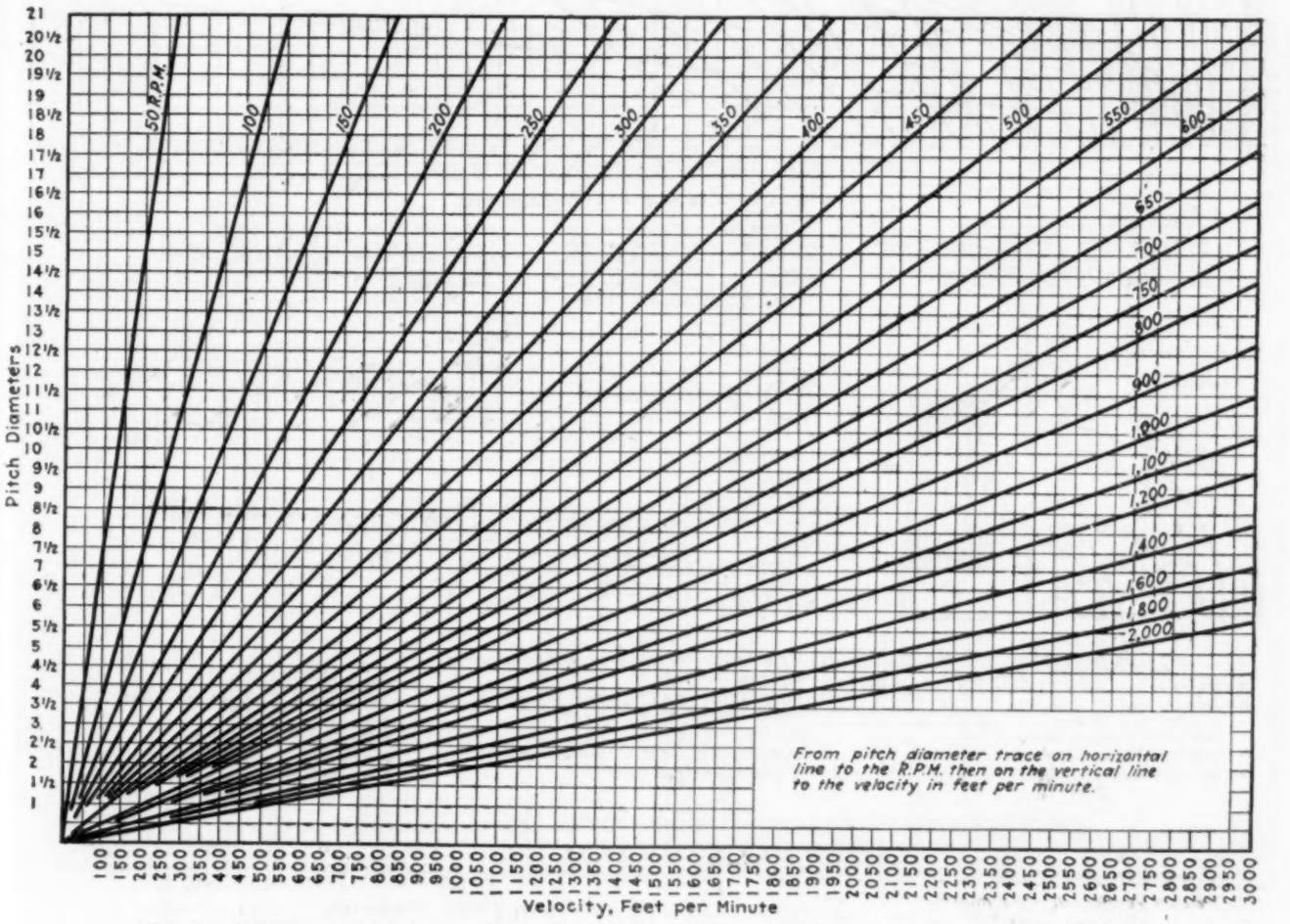
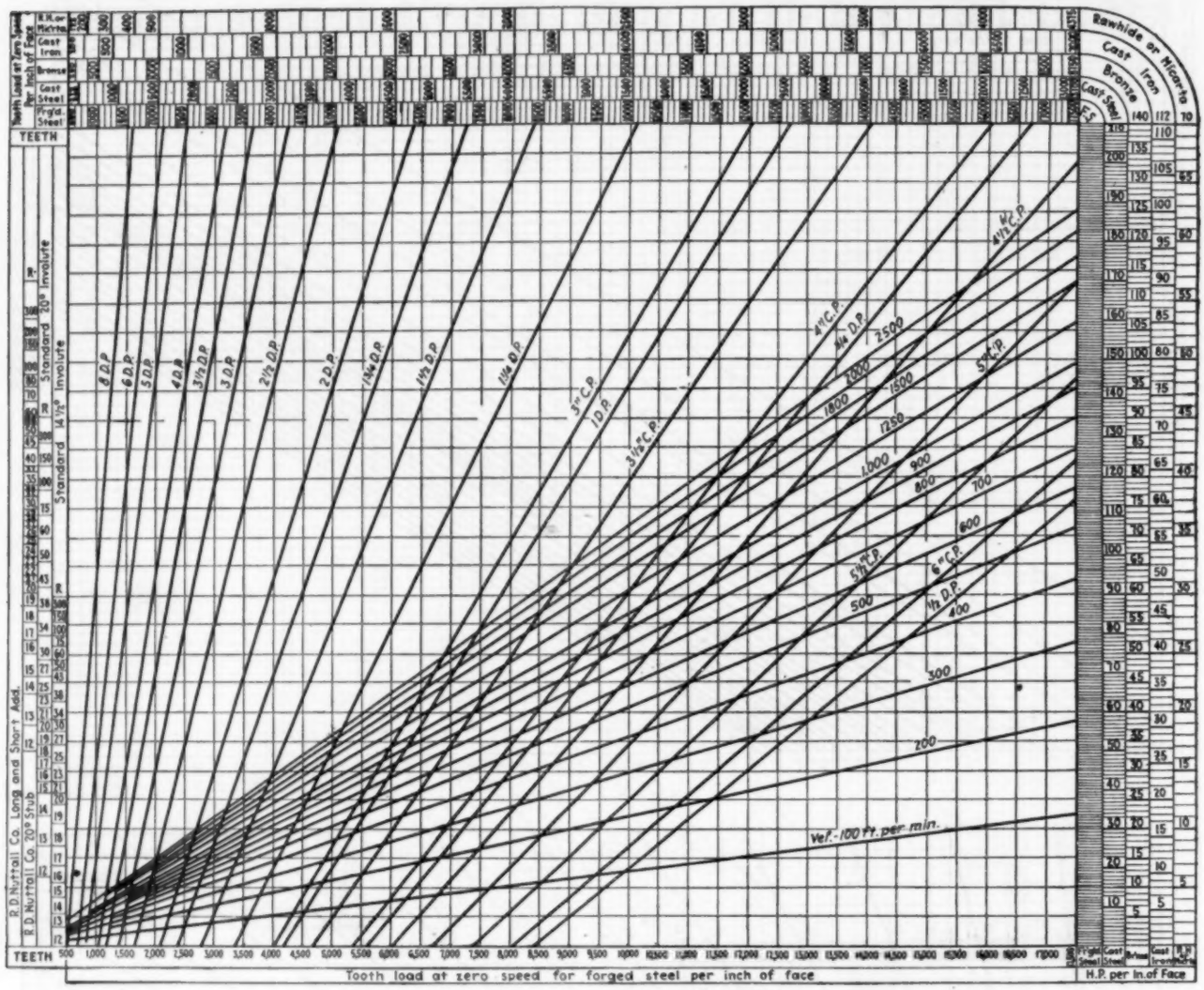


FIG. 1 (ABOVE). CHART FOR OBTAINING BORES. FIG. 3 (BELOW). CHART FOR VELOCITIES



Based on Lewis Formula $W = S.P.F.Y \frac{600}{600+V}$, $H.P. = \frac{W.V}{33000}$

To Find H.P. per Inch of Face

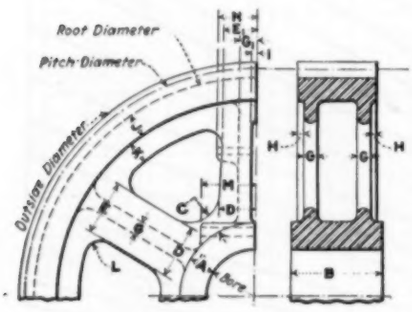
Trace on horizontal line from the style of tooth desired, to the pitch, then trace on the vertical line to the velocity, then on the horizontal line to the right for H.P. for material desired.

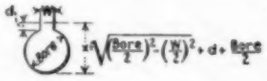
Fibre Stress of Material

Forged Steel	20,000 lb. per sq. in.
Cast Steel	15,000 lb. per sq. in.
Bronze	10,000 lb. per sq. in.
Cast Iron	8,000 lb. per sq. in.
Micarta or Rawhide	5,000 lb. per sq. in.

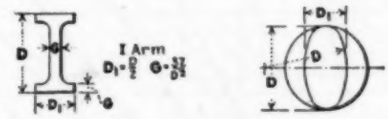
To Find Tooth Load at Zero Speed

Trace on the horizontal line from the style of tooth desired to the pitch, then trace up on the vertical line to the top for the load for the material desired.





$$\text{Bore} = \sqrt{\left(\frac{\text{Bore}}{2}\right)^2 - \left(\frac{W}{2}\right)^2} + d + \frac{\text{Bore}}{2}$$



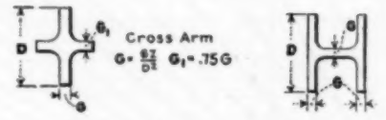
Arm Sections

Stalling load = SPFY
S = Stress of material
P = Circular pitch
F = Face
Y = Factor

$$Z = \frac{PFY \text{ Pitch radius}}{\text{No. arms}}$$

$$Z = \frac{\text{Stalling load} \times \text{Pitch radius}}{\text{No. of Arms} \times \text{Stress of material}}$$

$$D = 2\sqrt[3]{\frac{Z}{.3927}}$$



$$\text{Bore} = \sqrt[3]{\frac{H.P. \times 80}{R.P.M.}}$$ Chart No. 1

A = .64 bore or Hub dia. = 1.8 Bore. See chart No. 6

B = 1.25 bore. See chart No. 6 (For a gear with a face greater than 1¼ bore make equal to face, for split gears make to suit bolting.)

C = .655 A or bead dia. = 2.24 bore. See chart No. 6

D = See arm sections or chart No. 7

D = ½ D. (Only for split gears or I & Oval arms)

E = D - ¾" Taper per ft.

E1 = ½ E (Only for split gears or oval arms)

G = See arm sections or chart No. 7

G1 = .75 G.

H = .81 Face (Only for H or cross arms)

I = .44 G (Only for split gears)

$$J = \sqrt[3]{\frac{5 \text{ Teeth}}{\text{No. Arms}} \cdot \frac{}{D.P.}}$$

$$K = \frac{1.25\ J}{P.D.}$$

$$L = \frac{}{4.35 \text{ Arms}}$$

M = 2 A

N = E1 + ¼"

See chart No. 8

FIG. 4. CHART FOR DETERMINING HORSEPOWER AND STANDARD GEAR PARTS

P = Circular Pitch.
$D.P.$ = Diametral Pitch.
F = Face of gear.
Y = Tooth Factor from table No. 1.
$P.D.$ = Pitch Diameter.
T = Torque of Shaft in inch-pounds.

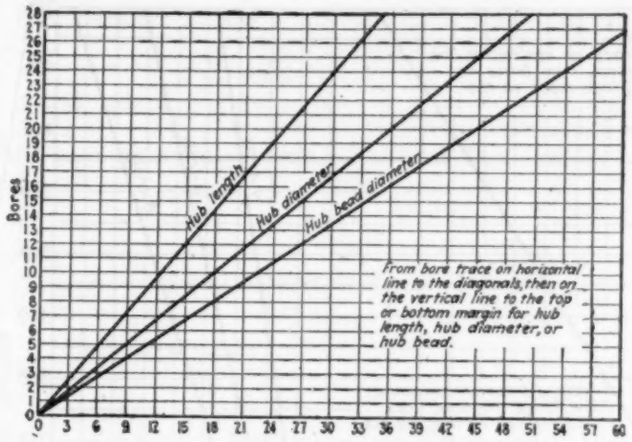

Bores
Hub length
Hub diameter
Hub bead diameter
From bore trace on horizontal line to the diagonals, then on the vertical line to the top or bottom margin for hub length, hub diameter, or hub bead.

FIG. 5. HUB DIAMETER, LENGTH AND BEAD

D = Diameter of shaft or bore of gear.

$$hp. = \frac{WV}{33{,}000} = \frac{TeM}{0.375} = \frac{T \times r.p.m.}{63{,}025} =$$

$$\frac{63{,}025 \times hp.}{r.p.m. \times PITCH\ Rad.} =$$

$$SPFY \left[\frac{600}{600 + V}\right]$$

$$0.746\ kw. = \frac{D^3 \times r.p.m.}{80}$$

$$Te = \frac{W}{R} =$$

$$\frac{Teeth\ in\ gear \times 24 \times Gear\ Efficiency \times Torque\ of\ Motor}{M \times dia.\ of\ car\ wheel}$$

$$T = \frac{63{,}025 \times hp.}{r.p.m.}$$

$$V = P.D. \times 0.262 \times r.p.m.;$$

$$kw. = 1.34\ hp.$$

$$P.D. = \frac{V}{0.262\ r.p.m.};\ r.p.m. = \frac{V}{0.262\ P.D.}$$

$$W = \frac{hp. \times 33{,}000}{V} = \frac{kw. \times 44{,}102}{V}$$

$$D = \sqrt[3]{\frac{hp. \times 80}{r.p.m.}}$$

Face of Spurs = 3 to 4 times circular pitch.
Minimum face of Helicals = 4 times circular pitch.
Minimum face of Herringbone = 6 times circular pitch.

To reduce the work involved to calculate a set of gears use the charts in the following order:

To Find Horsepower of Pinion

Chart No. 1 for bore.
Chart No. 2 for minimum pitch diameter of pinion for a certain pitch.
Chart No. 3 for velocity.
Chart No. 4 for horsepower.

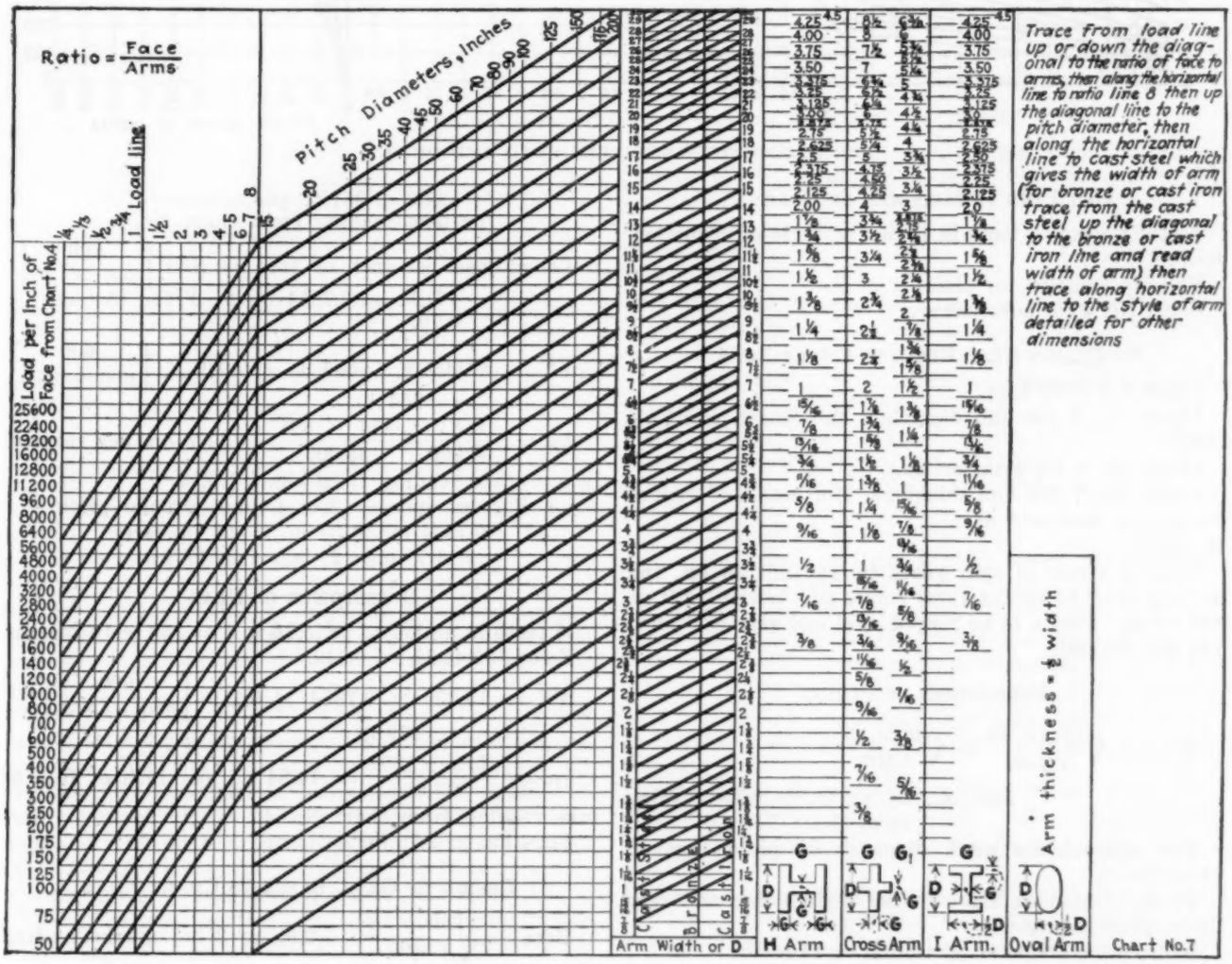

Ratio = Face / Arms
Load line
Pitch Diameters, Inches
Load per Inch of Face from Chart No. 4
Trace from load line up or down the diagonal to the ratio of face to arms, then along the horizontal line to ratio line 8 then up the diagonal line to the pitch diameter, then along the horizontal line to cast steel which gives the width of arm (for bronze or cast iron trace from the cast steel up the diagonal to the bronze or cast iron line and read width of arm) then trace along horizontal line to the style of arm detailed for other dimensions
Arm thickness = ¼ width
Arm Width or D
H Arm
Cross Arm
I Arm.
Oval Arm
Chart No. 7

FIG. 6. CHART FOR ARM SECTIONS

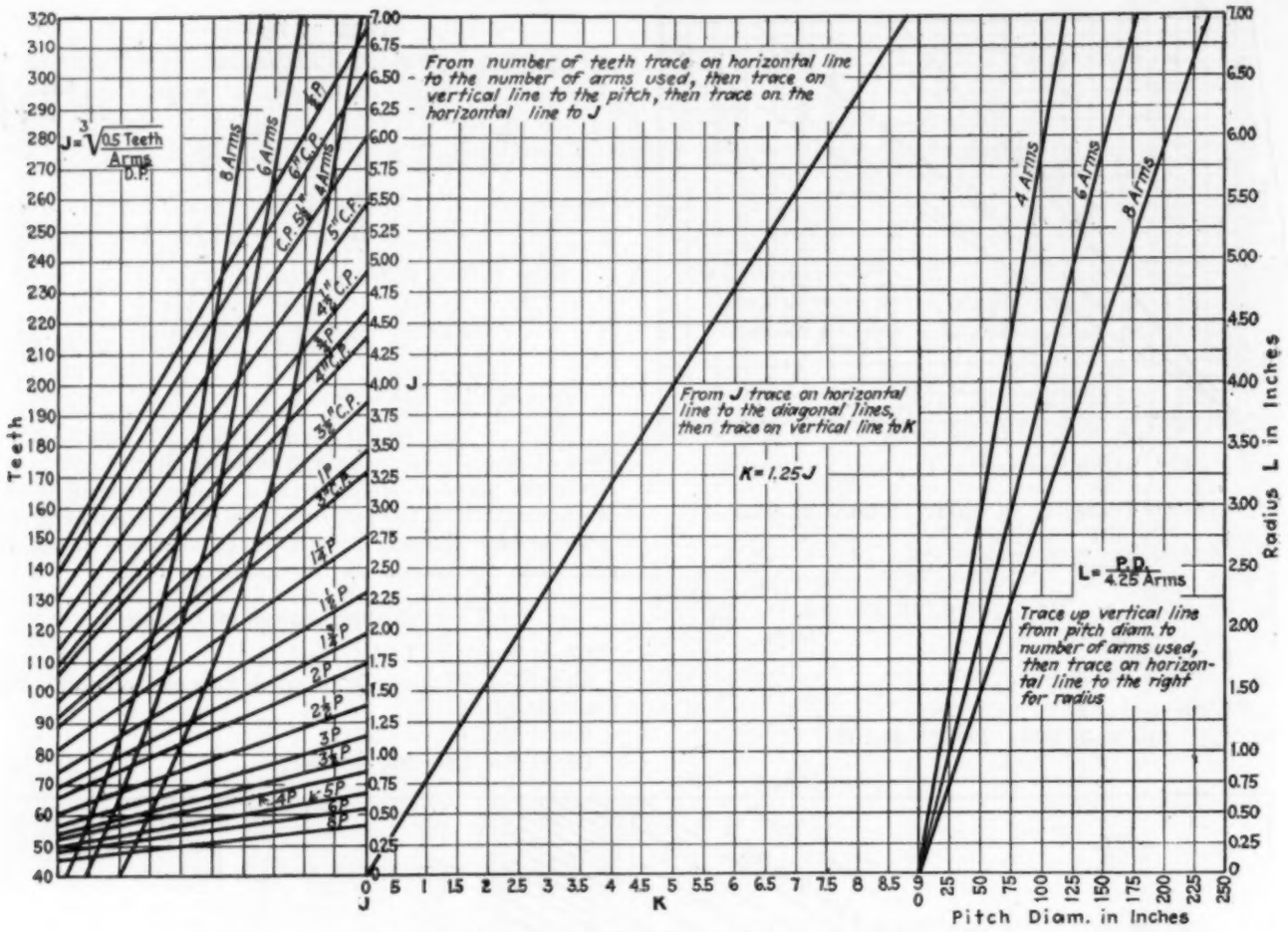

From number of teeth trace on horizontal line to the number of arms used, then trace on vertical line to the pitch, then trace on the horizontal line to J
From J trace on horizontal line to the diagonal lines, then trace on vertical line to K
K = 1.25 J
Trace up vertical line from pitch diam. to number of arms used, then trace on horizontal line to the right for radius
Teeth
Radius L in Inches
Pitch Diam. in Inches
J
K
8 Arms
6 Arms
4 Arms

FIG. 7. RIM THICKNESS, RIM BEAD AND FILLET

To Find Horsepower of Gear

Teeth in gear = teeth in pinion × ratio of reduction desired.

Velocity same as for pinion.

Chart No. 4 for horsepower.

To Design Gear Refer to Chart No. 4

Chart No. 1 for bore.

Chart No. 5 for hub diameter, hub length and hub bead.

Chart No. 6 for arm section.

Chart No. 7 for rim thickness, rim bead and radius connecting bead and arm.

EXAMPLE:

Wanted a pair of spur gears to transmit 30 hp., the driving shaft to run at 1,000 r.p.m. and driven shaft at 100 r.p.m. Pinion to be forged steel and gear cast steel 14½ deg. involute.

Horsepower of Pinion

$$\text{Bore} = \sqrt[3]{\frac{hp. \times 80}{r.p.m.}} = \sqrt[3]{\frac{30 \times 80}{1{,}000}} =$$

1.34 in. say 1⅜ in. or take reading from chart No. 1.

For approximate pitch diameter of pinion consult chart No. 2.

From 1⅜-in. bore trace to the 4-pitch line and read 3¼-in. pitch diameter.

3¼-in. pitch diameter × 4-pitch = 13 teeth.

$V = P.D. \times 0.262 \times r.p.m. = 3\frac{1}{4}$ in. × 0.262 × 1,000 = 851 ft. per minute.

or take reading from chart No. 3.

WF = load per inch of face = $SPY\left[\frac{600}{600 + V}\right]$;

4 $D.P.$ = 0.7854 in. P; Y for 13 teeth = 0.70.

$$WF = 20{,}000 \times 0.7854 \text{ in.} \times 0.070 \times \left[\frac{600}{600 + 851}\right] = 454 \text{ lb.}$$

$$hp. = \frac{WFV}{33{,}000} = \frac{454 \times 851}{33{,}000} = 11.7 \text{ hp. per inch of face}$$

or take reading from chart No. 4.

Face of spur = 3 or 4 times circular pitch.

0.7854 in. × 3½ in. = 2¾ in. face

11.7 hp. × 2¾ in. = 32.17 hp.

Horsepower of Gear

13 teeth in pinion × ratio 16 to 1 = 130 teeth in gear

Y for 130 teeth = 0.119.

$$WF = 15{,}000 \times 0.7854 \times 0.119 \left[\frac{600}{600 + 851}\right] = 579 \text{ lb.}$$

$$hp. = \frac{579 \times 851}{33{,}000} = 14.94 \text{ hp. per inch of face or}$$

take reading from chart No. 4

14.94 hp. × 2.75 in. = 41 hp.

Design of Gear, Refer to Chart No. 4

$$\text{Bore} = \sqrt[3]{\frac{30 \times 80}{100}} = 2.9, \text{ say 3 in., or take reading}$$

from chart No. 1.

Hub diameter = bore $\times$ 1.8 = 3 in. $\times$ 1.8 = 5.4 in., say 5⅜ in., or take reading from chart No. 5.

Hub length = bore $\times$ 1¼ = 3 $\times$ 1¼ in. = 3¾ in., or take reading from chart No. 5.

Hub bead diameter = bore $\times$ 2.24 = 3 $\times$ 2.24 in., = 6.72 in. say 6¾ in. or take reading from chart No. 5.

D = arm width; D_1 = arm thickness; $P.D. = \frac{130}{4} =$ 32.5 in.

$$Z = \frac{PFY \text{ pitch rad}}{\text{No. of arms}} = \frac{0.7854 \text{ in.} \times 2.75 \times 0.119 \times 16.25 \text{ in}}{6} = 0.695 \text{ in.}$$

$$D = 2\sqrt[3]{\frac{Z}{0.3927}} = 2\sqrt[3]{\frac{0.695 \text{ in.}}{0.3927}} =$$

$2\sqrt[3]{1.77} = 2 \times 1.21$ in. = 2.42 in. say 2½ in.

$D_1 = \frac{1}{2} D = 1\frac{1}{4}$ in., or consult chart No. 4 for load of 130 teeth, 4 P, 14½ involute and read, 1,700 lb. Then from chart No. 6 take reading of oval arm section of 2 ½ in. for D and $\frac{1}{2} D = 1\frac{1}{4}$ in. for D_1,

$E = D -$ ¾ in. per foot $\times$ length of arm from hub diameter to rim

$$= D - \left(\frac{\text{Rim dia.} - \text{Hub dia.} \times \frac{3}{4} \text{ in. per foot}}{2}\right)$$

$$= 2\tfrac{1}{2} \text{ in.} - \left(\frac{30\tfrac{1}{2} \text{ in.} - 5\tfrac{3}{8} \text{ in.} \times \frac{3}{4}}{2 \times 12}\right) =$$

2.50 — 0.80 = 1.70 in. or 1¾ in.

$$E_1 = \frac{1.75 \text{ in.}}{2} = \tfrac{7}{8} \text{ in.}$$

$$J = \frac{\sqrt[3]{\frac{0.5 \text{ teeth}}{\text{arms}}}}{D.P.} = \frac{\sqrt[3]{\frac{0.5 \times 130}{6}}}{4} = 0.55 \text{ in., or take reading from chart No. 7.}$$

$K = 1\frac{1}{4} J = 1\frac{1}{4} \times 0.55$ in. = 0.6875 in., or take reading from chart No. 7.

$$L = \frac{P.D.}{4\frac{1}{4} \text{ arms}} = \frac{32.5 \text{ in.}}{4\frac{1}{4} \times 6} = 1.27 \text{ in., say } 1\tfrac{1}{4} \text{ in., or take reading from chart No. 7.}$$

Elimination of Unnecessary Lines

The Fabricated Production Department of the Chamber of Commerce of the United States gives the following example of what can be accomplished in the elimination of unnecessary lines. A manufacturer of pipe and fittings tells the story of what was accomplished in his plant on standardization of product. His experience should prove of value to other branches of industry.

"The manner in which this problem of excess variety came to our attention was through the fact that, although we had large inventories in the aggregate, we also had huge shortages in many lines. Evidently, we had considerable dead stock on our hands. We were unable to give our customers the best service. We had large sums frozen in slowly moving merchandise inventories and were, consequently, losing profits.

"We catalogued some 17,000 different items of our own manufacture, but a most casual glance through our stores records indicated that there were hundreds, if not thousands, of these items in the slowly moving class. We decided, therefore, to determine which were the 500 fastest moving or most significant items. In order to do this, we tabulated by pieces and by weight our yearly sales, in terms of orders received at the factories, for a period of five years, and determined the yearly averages over this period. We found it expedient to expand our list so as to include 610 items.

"What did this simple analysis reveal? It showed us, much to our surprise that between 60 and 65 per cent of our tonnage output is represented by these 610 items. The answer was obvious. Thousands of the other items are, no doubt, very essential to the community, but there are also thousands of the other items for which standard material can be substituted. Our thought is to increase the size of our list of fast moving items, so as to embrace all items which we would stock. All other material would be considered as special and made on order only.

"By co-ordinating our production with the demand for these important items so as to always have them in stock, we hope to persuade the trade to take the standard material, and receive immediate delivery, rather than to wait for a somewhat modified pattern. The co-ordination of our sales and production is the extremely important consideration, as this will enable us always to supply our customers; it will allow us to maintain our inventories at the minimum, giving us a maximum turnover, and tying up a minimum of investment in merchandise."

Orders and Acknowledgments

BY L. G. STEBBINS

Nearly every purchasing agent has some method or system of insuring the prompt acknowledgment of orders. This is a very important part of the purchasing agent's work, as from a legal standpoint it is desirable, and in many cases necessary, to obtain a written acknowledgment of an order, so that evidence of a complete contract may exist if a suit at law becomes necessary. A simple system for handling this matter is described in the following paragraphs.

A carbon copy of each order is made out and kept on the desk of the purchasing agent, or his assistant. These copies are referred to daily, properly marked with the date acknowledgment is received and the carbon copy filed alphabetically to await receipt of the goods.

If no acknowledgment or invoice is received after a reasonable length of time, a short letter is written to the concern with which the order was placed, asking for an acknowledgment of the order. There should, however, be close co-operation between the various departments so that a letter will not be sent out asking for an acknowledgment when an invoice for the goods has already been received. Some large concerns have printed forms asking for acknowledgments; these are sent out with orders.

It is better to write an original letter asking for acknowledgment, when necessary, rather than to send out a printed form which is not likely to get prompt attention.

The acknowledgments as received are kept in a special desk file, and when the goods have been received and the transaction closed, the acknowledgments are destroyed.

Machine Tool Builders Hold Spring Meeting

Optimistic Gathering Devotes Itself Strictly to Business—New Constitution Adopted After Careful Consideration—Joint Standards Committee Gets Under Way

THE most noticeable feature of the semi-annual meeting of the National Machine Tool Builders Association was the general air of optimism and confidence in the future that was evident on all sides. Compared to the deep blue tinge of the previous meeting in New York and the gloom of a year ago the change was pronounced.

The convention was held at the Hotel Traymore in Atlantic City and was not so well attended as usual, which is not surprising in view of the depth of the depression through which the industry has been passing. No outside speakers were present and only one open session was held, on Tuesday morning, April 25, at which the reports of the officers were presented. In the afternoon an executive session went over the new constitution, as presented by O. B. Iles of the International Machine Tool Co., article by article, and adopted it almost without question.

Wednesday was devoted to meetings of the members of the different group committees and the convention broke up on Thursday.

Important Meeting on Standardization

Probably the most important action taken at the convention, aside from the adoption of the new constitution, was the standardization meeting. General Manager DuBrul and eight or ten of the members met with a committee of the American Society of Mechanical Engineers to formulate plans of organization for a joint committee on the standardization of machine tool elements to sponsor standards of this sort under the American Engineering Standards Committee. C. B. LePage, assistant Secretary of the A. S. M. E. in charge of standards work, was present and told of the methods of establishing standards under the direction of the A. E. S. C. The members of the committee present were H. E. Harris of the H. E. Harris Engineering Co. of Bridgeport, Conn., E. R. Norris of the Westinghouse Electric & Manufacturing Co., F. H. Colvin of AMERICAN MACHINIST and F. O. Hoagland of the Reed-Prentice Machine Tool Company.

It was finally decided to appoint a kind of steering committee to be composed of the five members from the A. S. M. E. representing engineers and users of machine tools, and five members of the National Machine Tool Builders Association to represent the producers, one for machines using revolving tools, one for machines where the work revolves, one for machines with reciprocating tools such as planers and shapers, one for grinding machines and one for presses and forging machines. The actual work of investigating and recommending standards will be done by subcommittees of the different groups of machine tool builders sitting with representatives of the users and engineers. Their findings will be cleared through the main committee.

It is a matter for congratulation that steps have finally been taken to start the work of standardization in the machine tool industry, so much needed for many years. Present plans call for consideration of very few elements at the beginning, dimensions of T-slots being the first on the list. The progress of the work will be closely followed by AMERICAN MACHINIST as a development which has long been advocated editorially.

High Spots in President Tuechter's Address

Some of the salient points in President A. H. Tuechter's address follow:

As I look back on the last eighteen months, it saddens me to think of what the machine tool business has gone through, and of the unnecessary, avoidable losses it has suffered. For, as I look about, I see other industries that are much better off because they were ready for the slump—good association work warned them of what was coming. How much loss our industry could have been saved if, before 1920, we had developed the constructive service, such as we have been developing by the last sixteen months' work!

The Bible tells us that "He who perseveres to the end shall be saved." Surely those lacking in perseverance are out of place in the machine tool business. From the high peak of war in 1917 or 1918, machine tool demand has dropped to the worst condition any of us have ever seen, and probably relatively the worst the industry has ever known. But are we down-hearted? No! Emphatically no! Serious, we are, of course; who wouldn't be serious in times like this, with orders dragging bottom for nearly two years past? The slow recovery of the world from its war debauch affords good reasons for us to take a serious view of life just now. But are we supine? Crushed? Far from it. Every well run shop in the industry has been overhauled; its equipment is put in tip-top shape, ready to go when the world gives the word. The drafting room of every well run shop is busy on improvements. When the world again needs new machine tools, we will be there with tools so good that the world will have to throw its old ones on the scrap heap. Preseverance and courage have always marked this industry in every depression, and they mark it now, as always before.

Value of Better Statistics

Many of us must make machines in advance of demand, and have them ready when the demand comes on us. Through lack of definite information on machine tool demand, some of us over-estimated our demand and thereby caused ourselves large losses. We had no lookout to warn us of the dead calm into which we were heading and in which we have been wallowing for months.

Some members now feel that the calm will be so dead for months or years to come that we don't need a lookout. All signs are now against that short-sighted attitude. Mr. DuBrul has pointed out that in times past, before we got orders, the world had to save up funds to buy machinery, and only after those funds were at hand, did our orders come on. Watching the situation as to available capital will enable us to forecast the right time and the wrong time to lay in the stocks we need. If our various groups will only help to make our statistics more complete, we need not repeat our old mistakes. Without them we will still have only rumors and hunches by which to guide ourselves. On the revival we might easily wait too long before starting up our idle shops. When demand again becomes strong enough to support us, we do not want to find our stockrooms bare, when we should have stocks on hand. We do not want to find ourselves trying to reorganize our forces after the labor market has been swept clean. A strong demand could easily creep upon us unawares, just as our overstocking came about, unless we have an observer who can read the business weather signs that indicate the return of demand.

If Europe settles down to work instead of waste, the endless wants of the world may create demand faster than we now think. We surely do not wish to be caught napping again, and we need not be, with a wide-awake lookout to give us warning that the wind is freshening off in the distance. This industry certainly needs someone whose duty it is to note the shadows that coming events may be

casting, unobserved by the busy executive who has many things to do. This industry needs the best service of this sort that it is possible to get, because we have so many complicated problems to solve, particularly in this excessive depression. I am convinced that we have just the sort of lookout we need.

The industry should not falter in the work it has started, and by which it can again put itself in a healthy condition.

Today we have progressed far, but much more remains to be done. Standardization and statistics are the two big things ahead of us. Statistical reports have been valuable to a few groups who have started them. They become more valuable as time goes on. We ought to make our statistical work cover every branch of the industry. That work repays active co-operation of the members in each group. As more groups join in, we can construct that reliable, trustworthy barometer that our manager has been so anxious to give us.

The wide variety in outlet, size and cost of the various machines made by our members, makes it possible for us to get a more reliable forecast than almost any other. Piecing our own information with that of other industries is the job that must go along with the betterment of our own statistics.

Demand for heavy machinery is preceded by abundance of long time investment funds, which is gaged by bond yields. Demand for light machinery is preceded by abundance of short time funds, gaged by commercial paper rates. Dr. Whaling, of Cincinnati, predicts the demand for iron and steel for some producers several months ahead with uncanny accuracy. We are learning how demand for our various types of machines tie in with iron and steel. If a few representative concerns will give our manager the figures on the past, as to orders and shipments, he can work out the past, and from that we can make better estimates on the future. Then, we will be able to tell better how to steer our businesses. Nothing but good can result from that sort of work. It is worth far more than the little trouble it takes to dig back into old records to work this out. Let us dig out our old mistakes and let our newer knowledge help us to avoid repeating them.

Importance of Standardization

Our industry has been backward in standardization, but we are now able to report definite progress. The American Engineering Standards Committee has invited us to accept joint sponsorship with the American Society of Mechanical Engineers on the project of standardization of small tools and machine tool elements.

The first project to be considered is T-slots. This element is common to all machine tools, but when gone into, is found to have some decidedly important features.

It must be confessed that the machine tool industry has no definite standards that have been duly accepted and promulgated as such.

Our customers are demanding standardization. Only recently, a builder of a certain type of machines was requested to make a certain minor change in his machine that only involved boring a hole to one dimension, rather than the dimension used by the builder. The user had over $5,000 worth of equipment which he was using on a machine of another make, which would have been useless unless the hole were bored to the proper dimensions on the machine he was then buying. Standardization of one hole saved $5,000 to that customer.

In England, the Machine Tool Builders Association has arrived at a standard for milling machine spindles, so that in the future, every miliing machine build in England will be able to use the same face mills, arbors, etc., that are used on every other English milling machine. It is understood that the English standard is based on some American practice.

If men think that there is not much to standardize, let them think only of those two instances and they will surely recognize that we are lax in our attitude, if we do not actively engage in this sort of work. Not only will we be lax in our attitude, but we shall lose money by losing orders, unless we enter into it.

Report of General Manager DuBrul

The world has been going through the worst depression it has ever known. The machine tool industry, that in its very nature must have deeper depressions than other industries, has not been able to escape the general conditions.

An association, to be successful, must essentially be an information bureau. Valuable information about any industry can only be gathered from the members of the industry. Much of that information lies useless simply because it is scattered and not co-ordinated. Gathered together in one place and pieced together in a systematic, co-ordinated whole, each fragment of information becomes more valuable to the man who contributed it than it was by itself in his sole possession.

To gather and co-ordinate information requires two things: the first being the spirit of co-operation. Industries that have developed this spirit to the greatest extent have made the greatest progress as industries; and the individual firms who are the best co-operators eventually make the greatest individual progress in these progressive industries. The second requirement is money to support the co-operative work. Industries that spend money freely but judiciously on their associations get the most information per dollar spent.

Information Worthless If Not Used

But merely collecting this valuable information is not enough. The members must learn how to use it, and must use it, if they are to get their money's worth. No man's business stands alone. Every business is merely a part of the huge co-operative system by which the world's wants are supplied from day to day. Inside your plants you are successful because you organize co-operation of producing elements. You must have co-operation of your suppliers to get your materials at the right time and the right price. Your customers must have your co-operation to get your products. Whole industries co-operate with other industries, in the last analysis, and information exchanged between industries is wonderfully helpful. If the blast furnaces as a whole had information as to foundry activity as a whole, they could produce in advance of the actual orders for iron, and the consumers would not suffer the present swift movements of prices caused by shortage of supply, which is due to ignorance of the course of demand for foundry products. Instances of this kind can be multiplied without end. But the information must be used by the individual in his own business, or it will be a childish expense to gather it. An association is not only a means of gathering information, but is a means of spreading knowledge of how to use the information. It is the post-graduate school in the University of Hard Knocks. Those who look on it in that light gain benefits far more than proportional to their expenditure of dues. No other university can recruit a faculty of so many experts who are, as a body, able to throw light on such a variety of problems as any first-class trade association has among its members.

Business Conditions in the Industry

From the figures we have, it is safe to judge that since the month of July, the shipments and orders of machine tools have been gradually increasing. The increase is slow, but it is encouraging to note that there is an increase. It would probably be imprudent for machine tool builders to count on a very fast increase. Just now optimism is spreading through the country, and yet this optimism may be premature for the machine tool trade. There are many conditions operative in the business world that make a swift recovery extremely improbable, and only if it is slow will it be a sound recovery.

One encouraging thing is that more and more members of this association are giving serious study to the necessary cycles in which this industry is bound to run, and are basing their policies for the future on that study. Some of our members have learned the hard lesson that it costs too much to depend on blind guess work and mere hunch playing in laying out their business policies. Every week the office gets a number of letters asking very keen questions in connection with different cyclical phases of the machine tool business. These questions show that some of our members are giving serious study to the fundamental factors and conditions of business in general, as these affect the machine tool business.

The last two years have seen some remarkable changes in the business policy of large concerns. Banks, merchandising and manufacturing concerns have seen the wisdom of employing economists as a part of their organization. The modern development of trade associations is along the very same lines. Only if operated according to economic and statute law can any trade association survive.

As a result of this depression, the business world is getting to realize that statistics are not merely a lot of dry figures that have no interest to anyone but a delver in the past. More and more large business organizations and trade associations are spending money on statistical work that will be a guide to their future policies. The profession of consulting economist is growing in the estimation of business men. Just as they consult engineers on many questions, they now call for interpretation and correlation of economic

facts. More and more, as time goes on, will statistical compilations be taken by business men to consulting economists for individual, private interpretation.

Regional Meetings on Amortization

In the Revenue Law of 1921 there is a provision limiting the time during which amortization claims may be filed to March 15, 1922. Probably every member is entitled to some amortization deduction—many of the members overlooked this source of relief from excessive taxation. Every dollar recovered will be a larger dollar than it was when paid. The dollars paid in were small dollars as measured by the amount of product sold at the high prices and large volume of 1918. The same dollar, if gotten back now, has a larger purchasing power, and it would take considerably more production, sold with more effort, at today's lower prices, with a smaller margin of profit, to get an equivalent purchasing power back into the manufacturer's cash account.

It was evident that we could render service to those members of our association who had utterly neglected amortization as a means of relief. To call it to their attention as well as we could, we not only sent out bulletins and prepared an article for AMERICAN MACHINIST, but also had a series of regional meetings to discuss this question. It was very encouraging to find that our campaign bore very rich fruit. At every one of these regional meetings there was someone who had been neglecting amortization, and who perhaps might have continued to neglect it, except for the association's campaign on that subject. The claims filed as a result of this campaign are claims for money which the law allows the machine builder to deduct, or to have refunded if he has paid it. Many members who have had only small amounts allowed could and should now revise their old claims and claim much larger amounts.

Many otherwise valid claims have been thrown out by the Amortization Section of the Income Tax Unit, merely because of improper presentation. When such claims have been properly revised they have frequently been allowed for much greater amounts than those that were originally rejected because of poor presentation.

The Amortization Section seems inclined to fix a basis below which they consider the price of machine tools abnormal, and they may attempt to settle amortization claims on this arbitrary basis. Your general manager contends that the proper price for the taxpayer to take, both as salvage and as value in use, is the price that a second-hand dealer will pay the taxpayer for the tools on which amortization is claimed. If surplus equipment is sold, a claim is settled on that sale price as a closed transaction, and there is no question of its fairness.

Now, it is an unchangeable principle of economic law that no commodity can have two prices at the same time in the same market; and in accordance with this law of single price, the same basis should be taken for valuing amortizable equipment that may be retained in use. It cannot have a greater value in use than it has on the market. Whether the Tax Unit will accept this point of view or not remains to be seen; but whether accepted or not, it is the only logical basis that can be taken, in justice and with common sense.

Washington Trade Association Conference

Secretary Hoover called a conference of trade association representatives, which was held on April 12. This conference was called to show the trade associations how the department can be of assistance to business, and to explain the sort of information that the department would like to gather, in co-operation with the associations. Your general manager attended this conference. It was a very large and representative gathering, comprised of between 500 and 600 associations' representatives. The conference took all day, and was opened with a very good talk by Secretary Hoover, who outlined the attitude of the department very clearly.

After the presentation of various views on the part of the government officials, trade association executives were called on by Secretary Hoover, who was presiding, to indicate the sort of co-operation that appeared to them to be desirable. Among those called on was your general manager.

It was evident that the minds of many of the executives present were relieved of the fear that may have haunted them that the Department of Commerce was going to try to impose anything on the associations. They were relieved to know that the conference was called in the spirit of co-operative helpfulness, and all were imbued with the desirability of co-operation in every way that would be possible.

It may well be said that one of the constructive results of this conference will be that many more statistics of different industries will be made available, and as a consequence, business men, statisticians and students of business will better be able to fit together many of the pieces of the Chinese puzzle they are confronted with in studying the business cycles, and in studying how one industry affects another, and how the demand comes on for some products before others—in other words, the whole interdependence of industry.

Cost Work

It was unfortunate, both for the members and for Scovell, Wellington & Co., our consulting accountants, that the industrial depression discouraged the cost work begun last year, and carried to the point of establishing a set of uniform principles, on which members are recommended to base their cost finding systems. It is very desirable that those who can possibly afford it, revamp their cost systems to put them in accord with these principles. This is the very best time to make changes in methods. If members wait until faced with a rush of business, they will be unable to do good revision work on cost systems. It is best done when the organization is able to give the question proper thought.

Now is precisely the time when members should be using the over-earned and un-earned burden accounts that were recommended in our cost plan. The man who divides his total expenditure for a month by the number of hours, or other divisor used to arrive at a burden rate, now gets such a ridiculously high figure that his good sense rebels. He simply casts it aside and gets no benefit out of the labor expended on it. Such a method has been described as giving merely an exercise in long division, but not giving costs. If, on the other hand, a concern has established a normal burden rate, its costs continue comparable during this sort of period. The difference between abnormal rate and the actual expenditure is taken into the unearned burden account.

As was pointed out in the cost conferences, the use of the un-earned and over-earned burden accounts enables the executive to determine the cost of necessary idleness, which must be recouped in his sales if his company is to prosper. True, the covering of these idleness costs can be done only when business is active. The standard or normal burden rate will show up higher than the actual month's expenditures during the period of activity, and will make a much saner basis of prices than the fictitiously low rate obtained by the long division method. It therefore affords a much saner basis for prices at all times, and permits executives to formulate their policies with knowledge.

Improvement of Our Own Statistics

As stated at the October meeting, it is perfectly possible for this association to construct a first-class business barometer for the industry. The sole requisite is that the members furnish the information.

To get a really worth while barometer, we should classify orders and shipments in groups covering all classes of machines according to their prices. The following classes were suggested:

(a) $250 and less
(b) Over $250 up to $500.
(c) " 500 " " 1,000.
(d) " 1,000 " " 2,000.
(e) " 2,000 " " 4,000.
(f) " 4,000.

Such a tabulation of orders each month, covering all kinds of machines coming within those price classes, would give a valuable picture of the progress of demand for the whole industry. About 100 members faithfully contribute to our present barometer, but it is deceptive, because it is based on the high prices ruling in the first quarter of 1920. Price reductions since that time make it impossible to judge the unit movement now going on, compared with the first quarter of 1920. Then too, the present curve is merely an average of various percentages that have no common base. Large and small machines are all lumped together. It would be much more worth while to note the movement of the different price classes, and be able to tell what is really going on. It would take very little work in the offices of the members to classify orders and shipments according to the price classes mentioned.

It appears reasonably certain that in the past, demand for small machines has revived before demand for large ones; and that conversely, demand for large machines fell off before orders for smaller machines went off. If we could get these data from the membership and put them together, many a manager could be helped in laying his plans for future production. At present he can only guess—and that means being wrong most of the time.

Ideas from Practical Men

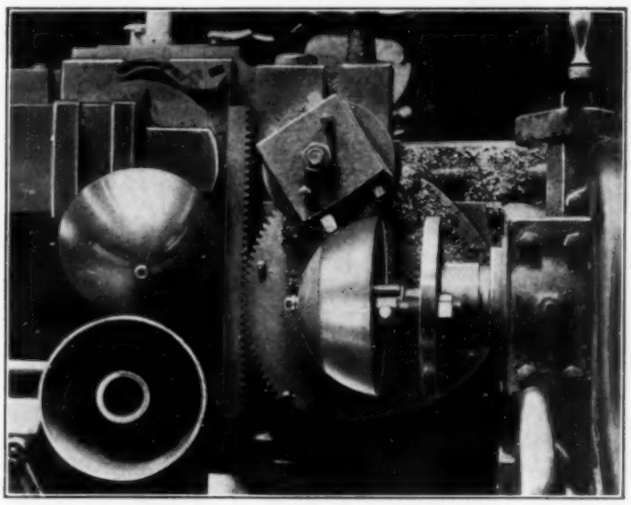
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Device for Turning a Hemispherical Casting

BY S. J. MORGAN

The photograph reproduced herewith was made by securing the camera in a vertical position directly over the lathe and looking down upon the work. It shows a radius turning device used in finishing the hemispherical surfaces of the frictions of toolroom drill presses that are a part of our regular line of manufacture.

The hemisphere is of cast iron and is bored, reamed and faced in a screw machine. It is then mounted upon the arbor of a special holding and driving device in the lathe and turned in the manner shown. The base of the fixture is bolted to the wings of the lathe carriage and the turning movement is imparted to it by means of a rack, attached to the cross-slide, meshing with the teeth



DEVICE FOR TURNING A HEMISPHERE

cut in the periphery of the circular member. The feed is driven by the crossfeed of the lathe.

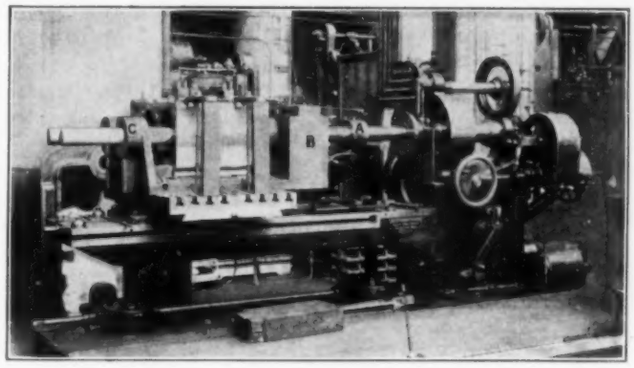
The operator polishes and balances each hemisphere before removing the casting from the arbor and the time for the complete operation averages 52 minutes.

Converting a Single-Spindle to a Double-Spindle Boring Machine

BY J. M. HENRY

At the plant of the Sullivan Machinery Co., Claremont, N. H. (manufacturer of mining machinery), there is an old model Niles boring machine that has been converted from a single- to a double-spindle machine by an ingenious arrangement. The machine is used for boring out twin-cylinder air compressors, one of which is shown in the illustration mounted on the table.

The regular spindle revolves and feeds in the usual



IMPROVISED TWO-SPINDLE BORING MACHINE

manner, but at *A* is shown the link which provides for mounting the two boring bars that actually do the work. This link is bronze bushed and collars on either side secured to and revolving with the bars, provide the means of feeding in and backing out.

The body of the fixture consists of a single casting, allowing for a locating surface for the work, a gear box *B* and supports for the two bars at *C*. The regular spindle extends through the link *A* and enters the gear box to provide the driving power. If the cover at the top were lifted off it would be seen that the gear box contains three spur gears, one for each spindle, splined to their respective shafts to take care of the endwise movements. The variations in speeds and feeds is controlled through the regular spindle movements.

Before this fixture was installed trouble was experienced with the single boring bar, as the pressure of the cutting tool had a tendency to break down the thin wall between the cylinders. With the two-spindle machine the cutters are so arranged that the pressure is equalized and no breakage is experienced.

Straightening Small Drill Rod

BY C. B. COE

Small wires, such as the smaller drill gage sizes of drill rod, sometimes becomes bent to such an extent that they may perhaps find their way to the scrap box. I have discovered a simple and effective way to straighten such wires, which has proved valuable to me, and it requires no special tools.

I grip one end of the wire in a drill chuck in the lathe and, with the lathe running at a fair rate of speed, rest the rod across the little finger and index finger of the right hand with the thumb pressing upon the wire between them. Starting at the chuck end, the hand is then passed slowly toward the outer end of the wire with the thumb exerting sufficient pressure upon the wire to bend it appreciably.

The rod may not be entirely straight after the first pass, but repeated trials will soon bring any but the most badly bent into shape.

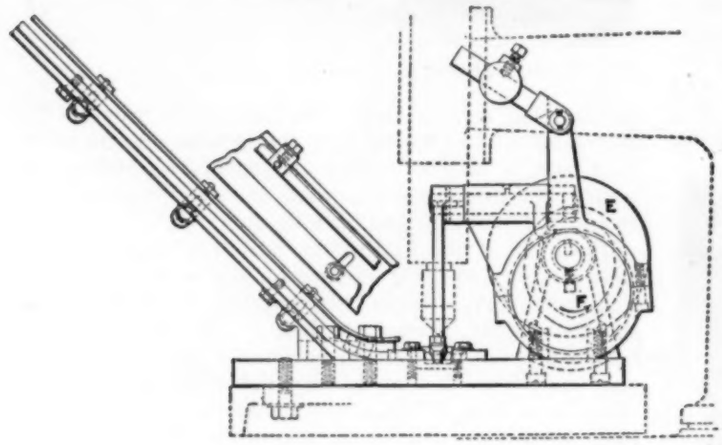
Drill Press Converted to Automatic Nut Countersinking Machine

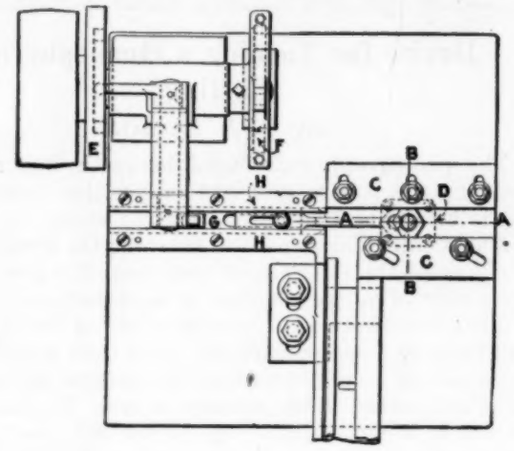
By Charles Kotersall

The device outlined in the accompanying drawings was attached to a 21-in. Barnes drill press, without elaborate alteration of the latter, for the purpose of countersinking automatically the under face of hexagon nuts of various sizes from ⅜ up to 1⅛ in. across the flats. The object of the device is to eliminate the necessity for the countersinking operation on the automatic screw machine and thus enable the latter to turn out four nuts per cycle instead of one.

The device is shown in projection in the three views; Figs. 1, 2 and 3 being respectively plan, front and side elevations. Like letters, so far as they appear, represent like parts in all views.

The baseplate of the device is bolted to the table of the drill press in such a position that the intersection of the two center lines *AA* and *BB* coincide with the vertical axis of the drill press spindle. Guides *CC* form a track in which the nuts may travel and are adjustable to and from each other to accommodate the different sizes of nuts within the range noted. The guides also prevent turning of the nuts under the countersink.





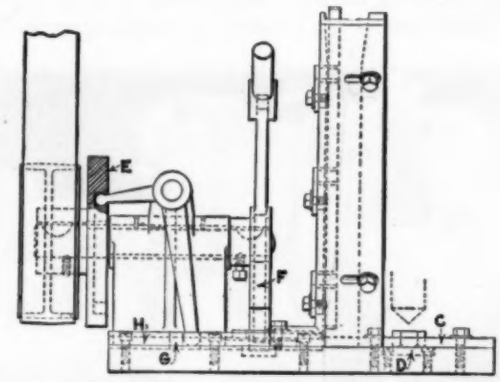


FIG. 1 (ABOVE, RIGHT). PLAN OF DEVICE FOR AUTOMATICALLY COUNTERSINKING NUTS. FIG. 2 (BELOW, RIGHT). FRONT ELEVATION OF DEVICE. FIG. 3 (LEFT). SIDE ELEVATION OF DEVICE

A hardened steel plate *D* is let into the cast-iron base at the intersection of the center lines to keep the nuts from wearing the cast iron rapidly at the place where the work is done.

A nut-chute, shown to better advantage in Figs. 2 and 3, was taken from an Acme six-spindle nut-tapping machine and fastened to the base of this device with capscrews in such a manner that it is readily adjustable to accommodate the different sizes of nuts.

At the rear of the fixture is a bracket carrying a short horizontal shaft to which is keyed a driving pulley, the face cam *E* and the eccentric *F*. A lever having a ball end is operated by the face cam and imparts a rocking motion to a transverse shaft, to the other end of which is pinned an arm that moves the slide *G* between the guides *H*. The slide *G* at each forward movement pushes a nut before it to the countersinking position and upon each withdrawal another nut enters the runway from the chute. The slide *G* is also made adjustable to suit the nuts.

The eccentric *F* through its connections operates the pinion lever of the drill press and thus imparts a vertical reciprocating movement to the spindle. The face cam *E* and the eccentric *F* are so timed with relation to each other that the countersink is at the bottom of its stroke at the same time that the feed slide is withdrawn to allow another nut to enter the runway. As the countersink always stops at the same height on each stroke, the adjustment for depth of cut as well as for different thicknesses of nut is accomplished by raising or lowering the table of the drill press.

The feed from the chute is by gravity only and all the operator is called upon to do is to keep the chute full. A nut therefore passes into the transverse runway by reason of the pressure of the work from above, every time the feed slide is withdrawn.

Use Paper Between Faceplate and Work

By Ernest E. Zeller

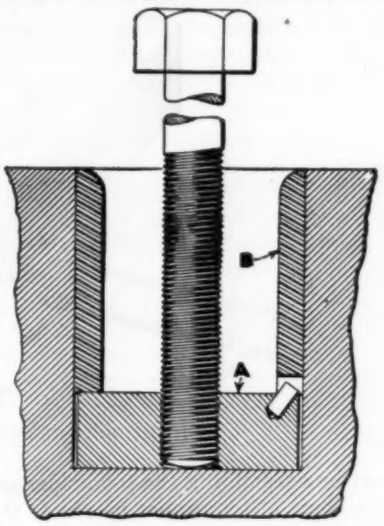
There is one thing that I think every machinist should be reminded of once in so often. It is to put a piece of paper between the faceplate and the piece to be clamped against it, and to use wooden blocks to support the clamps. Almost all machinists know that paper should be used in the manner described, but why do they not practice it? Apparently they think that they do not have time to do so, until someone gets his work, blocks and clamps all tangled up with his ears. That as a rule helps for a week or two and then it is forgotten. More work is spoiled and more accidents happen through this negligence than through any other cause.

Removing a Bushing from a Blind Hole

By W. H. Storey

On page 978, Vol. 55, of American Machinist, Charles Reimschissel describes a method of bushing a blind hole so that the bush can be readily extracted for replacement purposes.

A firm for which I worked many years ago used this method, but it caused considerable trouble because the screwed nut or bush at the bottom used to rotate with the stud and so become ineffective. Also, considerable time was wasted in searching for the large washer and the large bush necessary to use this device.



THE BUSHING AND THE KEYED NUT

I therefore adopted the idea shown in the illustration. It will be observed that a small pin is driven into the nut *A* which fits in a groove ground into the bush *B* and so prevents the former from rotating when the screw is turned.

To extract this bush no equipment is necessary other than a standard ½-in. bolt.

Wood Plugs in Pulley Bushings

By J. A. Raught

Regarding the use of wood as a bearing material, several times mentioned in recent numbers of American Machinist, I will give a few instances from my own experience.

In the planetary transmission of the Knox automobile built in 1904, there were wooden keystone-shaped plugs in the friction plates, and as I used this car myself, I know they gave satisfaction, although some one who had previously owned this car had removed several of the plugs, evidently to reduce friction.

The tumbling rod bearings on the old-time horse-power-driven threshing machine were wooden blocks, pinned to the ground with iron stakes; also the last joint of the tumbling rod which went from the separator to the ground was made of wood.

The step bearings of vertical waterwheels were made of wood. I know of one case where such a wheel was dismantled after 40 years of service and the lignum-vitae step bearing was found to be in good shape. Although thoroughly oil soaked it whittled more like soft brick than like wood.

The teeth in the bevel gears of waterwheels were, and I think are still, made of hard maple and are easily replaced. I think the reason for the wood teeth is to eliminate noise. The shaft bearings on some of the older waterpower plants were also made of wood. Some of those old plants are in existence today.

My father had a large weight-driven clock of Seth Thomas make, all gears of which were made of wood. The only metal part in the movement was the escapement.

The old-time farm wagon, although made nearly the same as it is today, was minus the cast-iron skein. The axles were wood (burr oak, I think) the ends of which served as bearings.

Although I am not an advocate of wooden bearings for all purposes, I think there are many places where they may be used to better advantage than metal.

Match Plate Pattern for Small Castings

By E. F. Oakford

After reading E. A. Dixie's article on the above subject on page 809, Vol. 55, of American Machinist, and tabulating the numerous operations described I brought the article to the notice of the foundry committee, which meets daily to discuss matters of interest regarding foundry work in the plant in which I am employed. The consensus of opinion was that a good deal of the work described by Mr. Dixie was unnecessary, and that a much simpler method of making the match plate could have been adopted.

Some time ago the writer contracted to supply four thousand iron castings somewhat similar to those described by Mr. Dixie—and owing to extreme urgency, delivery was promised in one week. One hardwood pattern with a short print at one end to support the center core as shown in the shaded portion in Fig. 1 was sent with the order.

The job was started at once, one patternmaker drilled the holes, 1 to 24, in the match board Fig. 2, while another turned up twenty-four solid patterns from a length of square sectioned hardwood, in a hollow spindle pattern-shop lathe. Allowance for draft was provided and the shanks of the patterns were increased in length equal to the thickness of the matchboard, as shown in Fig. 3. The twenty-four holes in the matchboard were drilled to the diameter of the pattern shanks. As soon as the plate was drilled the patterns were inserted in their respective holes, as in Fig. 3, fixed in position and the necessary gates shown in dotted lines in Fig. 1, fastened in place. A small hole for the runner stick was drilled at point 25. Two coats of varnish were applied, and the completed match plate was ready for use.

Owing to the free venting nature of our sand, it was not necessary to provide risers from any of the castings for such small work.

Twenty-four castings were made per flask and an output of between 50 and 60 flasks per day was secured, so that practically all the castings were delivered within the scheduled time.

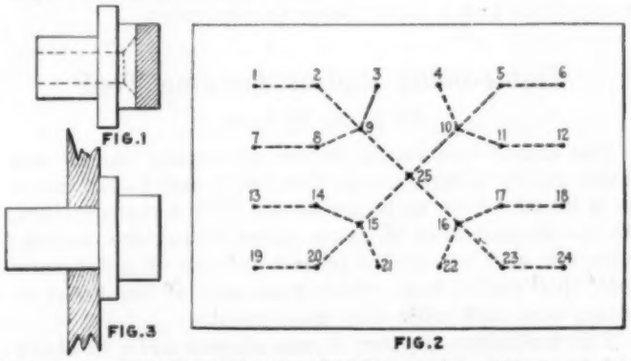


FIG. 1. PATTERN SENT WITH THE ORDER. FIG. 2. PLAN OF THE MATCH PLATE. FIG. 3. SECTION OF MATCH PLATE WITH PATTERN IN PLACE

A Shop Man's Method of Figuring Change Gears—Discussion

By W. G. Andrews

On page 78 of American Machinist, under the above title, J. Crommell gives a method of figuring change gears which is very good as far as it goes, but I think the hardest part has been left out (that is the hardest part for most men I have met), that of figuring compound gearing where finer or coarser threads are to be cut.

I will submit a method I use which is simplicity in itself.

As the pitch of the lead screw is to the pitch of the screw to be cut, so is the number of teeth in the wheel on the mandrel to the number of teeth in the wheel on the lead screw.

To calculate compound gearing proceed as follows:

Lead screw, 4. Thread to be cut, 40. Proportion, $\frac{4}{40}$. Factoring we have $\frac{4}{40} = \frac{2 \times 2}{5 \times 8}$. Multiplying by ten we get $\frac{20 \times 20, \text{ driving gears}}{50 \times 80, \text{ driven gears}}$. These wheels are always mounted as follows:

$$\frac{\text{Driving wheel on mandrel} \times \text{Driving wheel on stud}}{\text{Driven wheel on stud} \times \text{Driven wheel on lead screw}}$$

Another example:

Lead screw, 2. Thread to be cut, 25. Factoring we have, $\frac{2}{25} = \frac{2 \times 1}{5 \times 5}$.

As it is only necessary to multiply each pair of factors by the same number, we will multiply the first pair by 10 and the second pair by 20. Result $\frac{20 \times 20}{50 \times 100}$.

If any doubt exists as to the correctness of the calculation, the result may be easily tested as follows: Multiply the number of teeth in the driving wheels together, place these in fractional form and reduce to lowest terms. The figures obtained should be the ratio of the lead screw to the screw to be cut as expressed in lowest terms.

The proportions in the first example are 4/40 and the gears found were $\frac{20 \times 20}{50 \times 80} = \frac{\text{driving gears}}{\text{driven gears}} = \frac{400}{4{,}000}$. By cancellation we have $\frac{400}{4{,}000} = 4/40$, the original ratio of the pitch of the lead screw and the thread to be cut.

This method of figuring gears proved valuable to me many times and it is very easy to remember.

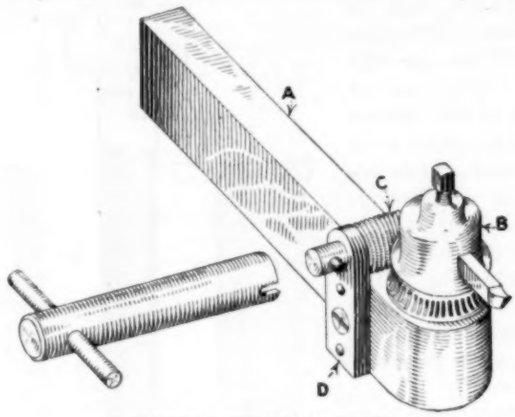
Home-made Radius Turning Tool

By K. A. Munson

The radius tool shown in the accompany sketch was made up for turning large fillets of 1 and 1¼ in. radius on a lot of valves to be machined from brass castings. As the shape had to be fairly accurate and the castings were not stiff enough to permit the use of a flat form tool, this radius tool, which took only a few hours to make, was used with very good results.

The toolholder support *A* was shaped down to standard ½ x 1 in. tool size to fit toolpost in lathe. A head was left on one end of this toolholder support in which was bored a hole to receive the shank of the swinging toolholder *B*. The toolholder was made a nice turning fit in the support and secured by means of a washer and nut on the under side. A hole was broached in the toolholder to receive a $\frac{5}{16}$ in. square toolbit, and a setscrew provided for clamping it.

The toolholder *B* was turned up similar to a small worm wheel blank, as shown, and the teeth in it were



A RADIUS TURNING TOOL

cut by assembling the toolholder and support and clamping them at the proper height in the toolpost. A ½-in.-13 U. S. S. tap was dogged between centers in the lathe, and by feeding in the toolholder slowly and using the tap as a hob, the teeth were very quickly cut without the necessity of gashing.

The worm *C* was a ½ in.-13 stud turned down at both ends for the side plates *D*. Both worm and toolholder were cyanided to give as much life to the teeth as possible

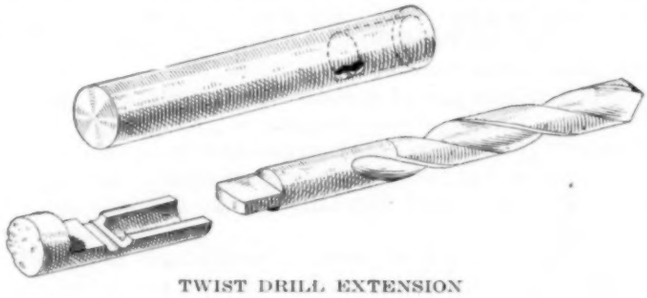
Extension for Small Twist Drills

By F. R. McCurdy

A quickly and easily made extension for small twist drills is shown in the cut herewith.

Take a pice of cold-rolled rod somewhat larger in diameter than the drill it is desired to extend and, at a safe distance from the end, drill a crosshole smaller in diameter than the drill. Plug this hole and then drill a second hole to cut into the first one as shown.

Now knock out the remains of the plug and, with the drill it is desired to extend, drill a hole into the end of the rod as far as the crossholes. Next file flats upon the end of the drill shank to match the diameter of the



TWIST DRILL EXTENSION

crossholes, and drive the drill into the end of the rod so that the flatted end enters the slot made by the two crossholes.

The writer has drills and taps extended in this way that have been in service for ten years.

Editorial

Are We Downhearted?

THE beginning of President A. H. Tuechter's address to the Machine Tool Builders at Atlantic City has in it this question, "Are we downhearted?" He answered it with an emphatic no and his sentiments were those of the great majority of members present. And with good reason.

Some saw the new radio industry absorbing all their stocks of certain models and crying for more, most of them had taken on men, all of them had more inquiries and generally better business in April than in many months. One manufacturer was heard to say that if the remaining months of the year were as good as April he would have nothing left to ask for.

The report of the association's general manager told of a slow improvement in business trend since July, 1921. A warning not to expect anything startling in the way of rapid recovery was also included but the substantial nature of what is going on is further indicated by the fact that the figures, being on a dollar basis, do not reflect the real improvement. Not only is the dollar of 1922 more valuable in purchasing power than that of a year ago but machine tool prices are considerably lower and consequently there would be a much more evident increase in shipments if tons or number of machines were the units used.

Sentiment is a big factor in the business world and has much to do with the fluctuations which make up the business cycle. When it is optimistic and has the backing of the cold figures of the economic statistician to back it up, we may well take heart. The year 1922 may not prove to be a very profitable one for machine tool men but it is starting out with a promise far beyond expectations.

Machine Tool Standardization

A STEP that means much to the men who use machine tools was taken at the spring convention of the National Machine Tool Builders Association. By invitation of the American Engineering Standards Committee the association becomes joint sponsor with the American Society of Mechanical Engineers for standards for machine tool elements.

As told in the report of the meeting on another page the A. S. M. E. committee has been appointed and an organization meeting with machine tool men has taken place. Perhaps too much emphasis should not be placed on the preliminary steps in the attempt to secure machine tool standardization. Other committees have been appointed and have accomplished little.

We must confess, however, to a feeling of confidence that something will be accomplished by the new committee. The user is becoming wide awake to the meeting of standardization in dollars and cents and his voice is being listened to with flattering attention by the manufacturer at the present time. According to the present arrangement he is to have a voice in this standardization movement through the A. S. M. E. representation on the committee. When the work gets down to brass tacks he will have a further chance to say what he thinks should be done and he will have only himself to blame if the standards that are finally adopted do not meet his requirements.

Standardization has also a direct money-saving appeal to the manufacturer. Simplification of product and elimination of unnecessary sizes can accomplish wonders in the machinery industry as they have in other industries. Personal preferences in minor matters may have to go by the board for the general good but even though such action hurts at first, it is soon forgotten. Does anyone look back with much envy to the days when there were no screw thread standards?

A Question of Prices

ONCE in a while we find a buyer of machine tools who appreciates their value and also the question of price. One such buyer made ice cream freezers for hotels. He had bought a boring machine and as the maker happened to be in town shortly afterward he dropped in to see how things were going.

"Fine machine you sold me," said the buyer. "Does my work well—does it quickly, does it accurately. But if you'll pardon my apparent rudeness I'll say you were a d—— fool to sell it to me for two thousand dollars.

"That machine will bore more ice cream freezers than I can ever sell. I'll never have to buy another. You've made your only profit on me and I'm making mine on you every day. My ice cream freezer isn't half so much of a machine as yours. Its rough and crude in comparison. Yet I get as much money for it as you asked me for your high-grade, accurate machine. My machine lasts for years also, so I charge a high price for it as the user gets his profit out of it for years and years. You ought to do the same."

Opportunities for New Machine Operations

A RECENT incident may point out a lesson with great possibilities. A machine builder and a "five and ten" merchant were recently traveling together, and the subject of bent-end curtain rods came up. It developed that, in spite of being sold in the ten-cent stores, the rods were all bent by hand.

The machine builder got buzy and designed a machine for the job. Then he got the name of the maker from the "five and ten" merchant and promptly sold him several machines.

This is another example of the point brought out by Mr. Berry, of the Warner & Swasey Company, some time ago in these columns. They found that by careful study and intensive work 60 per cent of their sales were to lines which had not previously been considered as possible customers.

If ten-cent curtain rods are being built by hand, how many other articles are equally susceptible of cost reduction by machine methods? What better work for a live trade association than searching for outlets in new fields, for the products of its manufacturers?

Shop Equipment News

Cross Gear-Tooth Rounding Machine

The Cross Gear and Engine Co., Detroit, Mich., has recently re-designed its gear-tooth rounding machine, which was described on page 438, Vol. 46, of AMERICAN MACHINIST. The machine, shown in Fig. 1, is intended for accurately rounding at high speed the corners on the ends of gear teeth. This action can be performed on spur gears of both the straight-tooth and the helical type, as well as on both the inside and outside edges of spiral bevel gears and pinions.

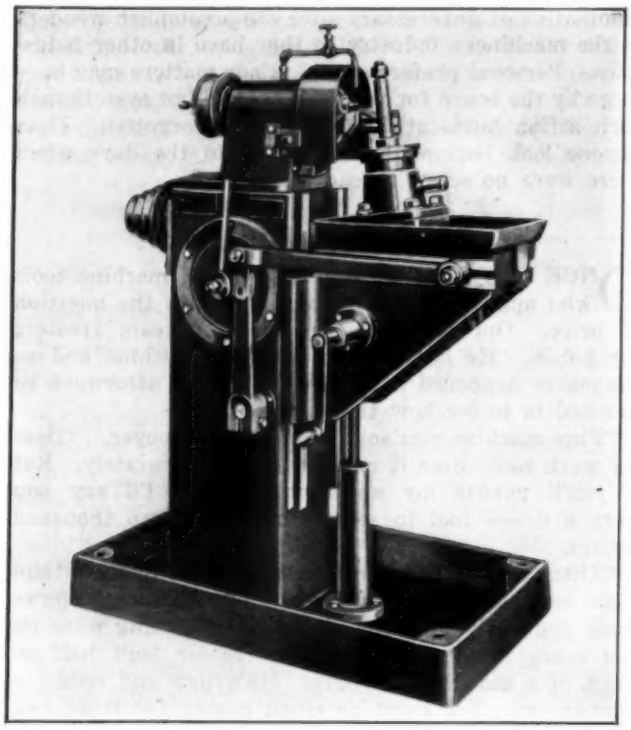


FIG. 1. GROSS GEAR-TOOTH ROUNDING MACHINE

Gears of any pitch within the capacity can be finished with but minor adjustments of the machine. Stem gears, cluster gears, gears integral with the shaft and those cut close to a shoulder can be finished. The operation is performed at high speed, so that the machine can be employed for large-scale production. The construction of the machine and the method of locking the gear in position provide rigidity. A production of 40 to 45 teeth per minute on certain classes of work is stated to be maintained continuously. Due to the fact that the machine is entirely automatic in operation, no particular degree of skill is required by the operator. A smooth finish is obtained and cutter breakage is very slight.

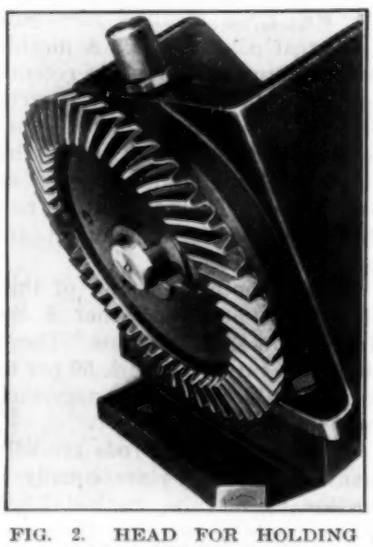


FIG. 2. HEAD FOR HOLDING SPIRAL BEVEL GEARS

The cutter is rotated at high speed by a belt on the pulley at the rear of the head. The cutter spindle runs on ball bearings mounted in a housing that is set eccentrically in a quill in the head of the machine. The amount of eccentricity can be varied to suit the thickness of the tooth being rounded. The spindle thus oscillates through a semi-circle, traveling across from one side to the other of the tooth profile. The quill is mounted in adjustable taper bearings to give compensation for wear. The adjusting nut is at the rear of the head. The screws for adjusting the eccentricity pass through the taper bearings. A gear on the back taper bearing engages with gearing driven from a vertically oscillating rack operated by mechanism in the column.

The gear is held in position on a table in front of the head. A stop immediately below the cutter fits in the space between the gear teeth, so that the tooth is held rigidly in place while being finished. It is not necessary to center the gear accurately, as the stop itself holds each tooth in the proper position for cutting. When the cut is complete on one tooth, the work table slides forward and the work indexes. The same mechanism that sets the eccentricity of the cutter spindle automatically adjusts the indexing for any number of teeth of the required pitch.

The machine can be furnished with special heads for carrying the gears. A large head is used for heavy gears, such as those on the rims of flywheels. For gears mounted on shafts, provision is made to extend the shaft through the table. Bevel gears are mounted at an angle, so as to bring the edge of the tooth in the same position as that ordinarily occupied by a spur gear tooth. In Fig. 2 can be seen an indexing head for holding spiral bevel gears. Other attachments suited to special work can be furnished.

The machine can be equipped for motor drive, the motor being placed on a separate base at the rear, and belted through a countershaft to overhead pulleys carried at the back of the machine. An oil pump, piping and guards, as well as a cutter, arbor and gear-holding head, are furnished with the machine.

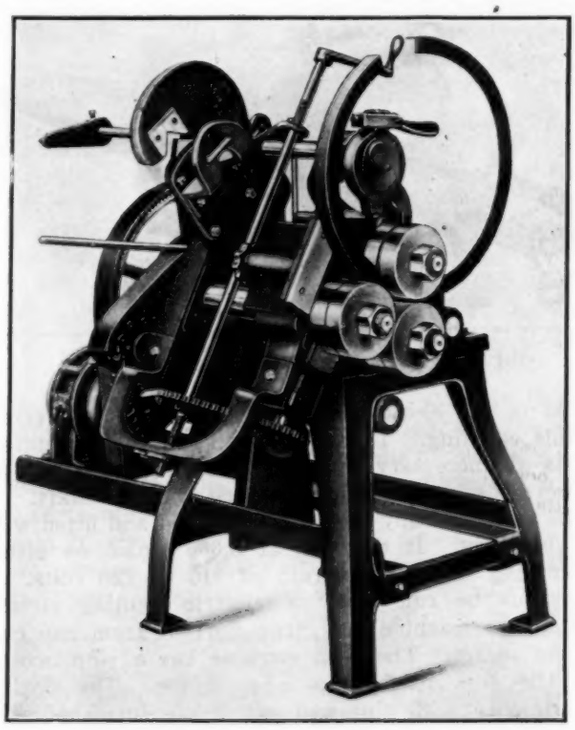
The machine is made in three sizes. The No. 1 has a capacity up to 24 in. in diameter on gears of 4-pitch or finer and of 16 in. on gears up to 2-pitch. It occupies a floor space of 3 x 4 ft. and has a weight of 1,700 lb. The No. 2 machine can handle gears up to 4-pitch 36-in. in diameter, and up to 2-pitch 30 in. in diameter. The floor space is 3 x 5 ft. and the weight 2,100 lb. The No. 3 machine handles gears of 1 to 4 pitch up to 60 in. in diameter. It requires a floor space of 4 x 7 ft. and weighs 4,200 pounds.

Excelsior No. 14 Angle-Bending Machine

The machine shown in the accompanying illustration is intended for bending angle iron into circular form. It has recently been placed on the market by the Excelsior Tool and Machine Co., East St. Louis, Ill., and is designated as the No. 14 machine. It will cut to length and bend angle iron up to 2 x 2 x ¼ in. in size, and a true circle can be formed without twisting or defacing the angles. Bar iron and T-iron can also be formed with the same rolls, which are adjustable in position to suit the requirements. Special rolls are required for pipe and channel iron or other unusual shapes.

All three roll shafts are driven, so that small circles can be rolled by one pass through the machine with the ends actually closing together. There are two rolls on each shaft, and steel washers are placed between each pair of rolls to allow for the insertion of one leg of the angle. Each roll has one straight and one rounded edge. This equipment permits of rolling circles with the flange to either the inside or the outside. A guide insures that the angle iron takes the proper path and is not distorted. On angle iron 1½ x 1½ x ⅜ in. in size, circles as small as 14 in. in diameter can be formed by two passes through the machine.

The machine is equipped with a friction clutch, and can be adapted to either belt or motor drive. It can be started or stopped with the work under pressure. The frame is semi-steel, and the rolls are made from



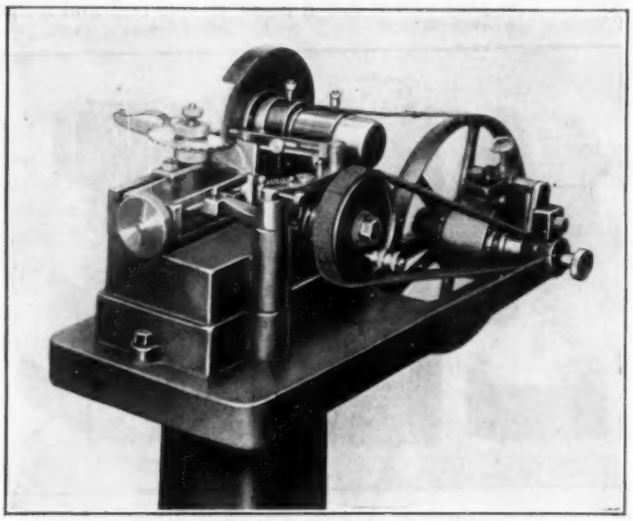
EXCELSIOR NO. 14 ANGLE BENDING MACHINE

forged and hardened tool steel. They are driven by gears with a 14:1 ratio from the driving pulley. This pulley ordinarily rotates at 200 r.p.m., and 3 hp. is required to operate the machine.

The machine may be furnished either with or without the cutting attachment or the motor drive. It has a height of 5 ft. and requires a floor space of 4 x 5 ft. It weighs 1,800 lb. without the motor and shearing attachment, the weight of the latter being 200 pounds.

Scherr Automatic Saw Sharpening Machine

George Scherr, 126 Liberty St., New York, N. Y., has recently added a No. 2 size to his line of automatic saw sharpening machines. The machine is larger than the



SCHERR NO. 2 SAW SHARPENING MACHINE

No. 1 model, and intended for sharpening circular saws from 1½ to 8 in. in diameter. It is used on all types of circular metal saws, screw slotting cutters and jewelers' and slitting saws. The machine, as shown in the accompanying illustration, is self contained and mounted on a cast-iron column.

Saws up to ⅛ in. thick and having holes from ⅜ to 1 in. can be handled. Indexing is done by means of the saw being sharpened, so that variations in distance from tooth to tooth cause no difficulty. The machine will feed saws with teeth broken out, so that damaged cutters can be re-conditioned.

The machine carries a wheel 4½ x ⅜ in. in size, the bearings of the grinding spindle being tapered so that adjustment for wear can be made. The tight and loose pulleys are 3 in. in diameter and ordinarily run at 650 r.p.m. The machine measures 12 x 24 x 36 in., the column being 30 in. high. The net weight is 135 pounds.

Marvin & Casler Jack, Blocks and T-Slot Nut

The Marvin & Casler Co., Canastota, N. Y., has recently brought out some equipment for use on the tables of machine tools when setting up work. The T-slot nut shown at the right of Fig. 1 is intended particularly to permit of putting additional clamps on work secured to a machine table, although it can, of course, be employed when the work is first clamped down. If an additional bolt is needed on the set-up, the nut can be slid in position from the end of the T-slot and the stud or bolt with its clamp can be inserted from above. In this way, it is frequently possible to avoid resetting the work, as would be necessary to add T-head bolts of the ordinary type.

There is no danger of the nut injuring the T-slot, as happens with a T-head bolt which is permitted to turn in the slot and damage the edges. The nut presents a large wearing surface to the slot. Its use permits of a reduction in the cost of clamping equipment, as studs of all lengths can be employed with it. The nut can

be furnished with threads from ¼ to 1 in. in diameter. The widths of the heads vary from 1 1/16 to 2 in. and the lengths from 1½ to 3 inches.

On the left of Fig. 1 the top illustrations show jacks that are for use on machine tables when leveling the work. The jack screw has a point at one end and a flat

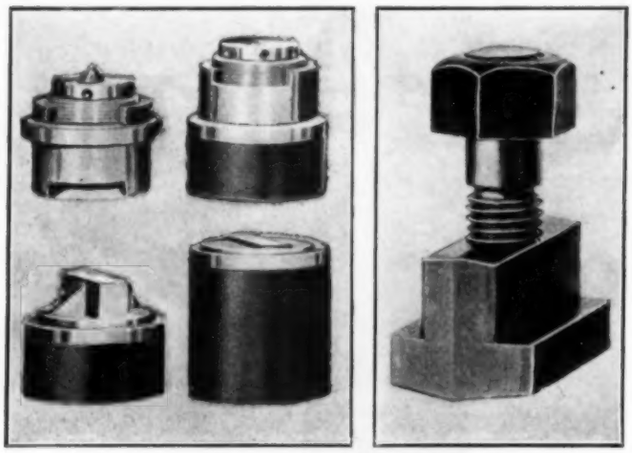


FIG. 1. MARVIN & CASLER T-SLOT NUT, JACKS AND EXTENSION BLOCKS

surface on the other. Thus, either end of the screw can be brought in contact with the work by merely reversing the position of the jack. The screw has an extension of ⅝ in., and its pitch is fine enough to prevent it from running down while the cut is being made. For small heights, the jack may be placed directly on the table of the machine, its minimum height being 1¾ in. to the top of the point and 1½ in. to the top of the flat surface.

When desired to increase the height of the jack, tubular extension blocks are placed under it. The blocks fit around the jack, the flange of which bears on the top of them. Several extensions can be placed on top of each other, so as to provide a block of any height necessary. Two of the extensions are shown at the bottom on the left-hand side of Fig. 1. It will be noted that there are blocks on top of each extension; they are employed both as bearing surfaces for the work and as locaters to use between sections of the extensions.

The extension or tubing is about 2⅜ in. in outside diameter and made up in lengths of 1, 2½, 4¾ and 9½ in. Fig. 2 shows a large aluminum casting clamped to the table of the machine and supported by the jacks and

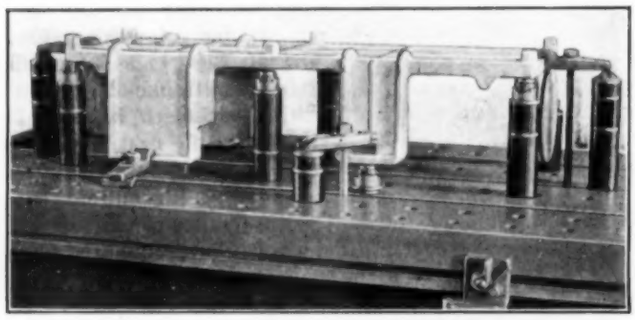


FIG. 2. WORK SET UP ON JACKS AND EXTENSION BLOCKS

extension blocks. The flexibility of the arrangement should be noted, as it is possible to quickly obtain the exact height necessary under any part of the work.

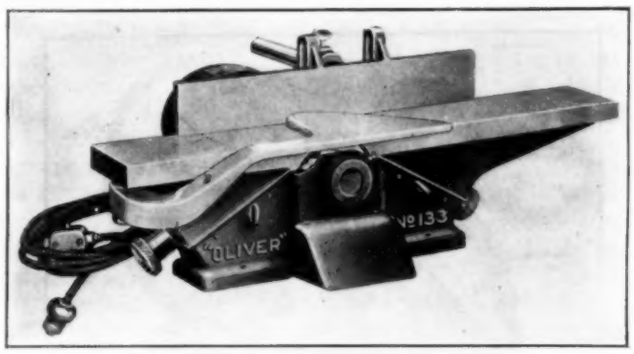
Oliver No. 133 Hand Planer and Jointer

A portable, ball bearing, motor-driven hand planer and jointer that is intended for mounting on a bench has recently been placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. The machine is designated as the No. 133, and is made in 4- and 6-in. sizes. The 6-in. machine planes 6¼ in. wide, and the 4-in. machine 4¼ in. wide. Both sizes rabbet up to ½ in. The machine is intended for replacing the hand plane when jointing and fitting wood.

The base is a one-piece casting, and carries all of the parts of the machine, so that the whole unit may be easily moved from one place to another. The tables are mounted on inclined dovetailed ways, and are raised and lowered by means of handwheels and screws. Each table has a steel lip next to the throat opening. The full height of the table is 6 inches.

The fence can be quickly adjusted to any position on the tables, and tilted and locked. When not in use, it may be moved back and swung out of the way. An aluminum safety guard that operates automatically is provided on the table. It keeps the unused portion of the knives covered, and yet does not interfere with the operation of the machine.

The cutter head is fitted with three tungsten-chromium steel knives, each ⅛ in. thick and 1 in. wide. The cutting diameter is 3½ in. The head runs on self-aligning, inclosed ball bearings, and is directly con-



OLIVER PORTABLE PLANER AND JOINTER

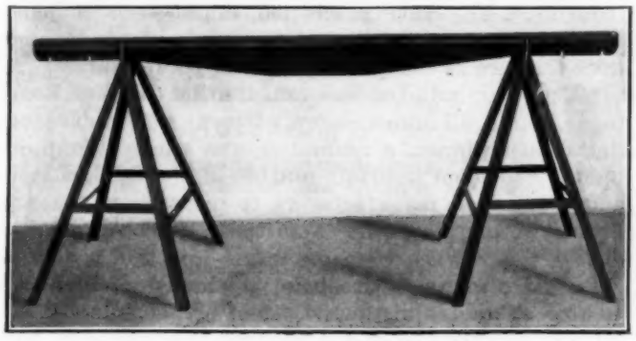
nected to the electric motor by means of a universal flexible coupling. Thus, no belts, pulleys or countershafts are necessary, and the machine may be set up wherever desired without reference to a line shaft.

The motor is fully inclosed, ventilated and fitted with ball bearings. It operates at 3,600 r.p.m. on either alternating or direct current of 110 or 220 volts. It may thus be run from an electric lighting circuit, so that the machine may draw current from any convenient socket. The 6-in. machine has a ⅓-hp. motor, and the 4-in. machine a ¼-hp. motor. The flexible electric cord with plug and switch are furnished with the machine. A rotary snap switch is provided when an alternating current motor is used.

An attachment may be furnished for setting and sharpening the knives, so that they all cut uniformly. A cast-iron column for supporting the machine from the floor can also be provided. The bench space required by the 4-in. machine is 26 x 16 in., and by the 6-in. machine 32 x 18 in. The machines weigh 130 and 160 lb., respectively, when crated, and 165 and 200 lb. when boxed. The contents of the export boxes are 3 and 4 cu.ft. respectively.

Eureka Demountable Steel Trestle

Reinhold Bettermann, Johnstown, Pa., has recently placed on the market a demountable trestle or "horse" for use in an industrial plant to support work. The



EUREKA DEMOUNTABLE STEEL TRESTLE

principal feature of the device is that it is made entirely of steel.

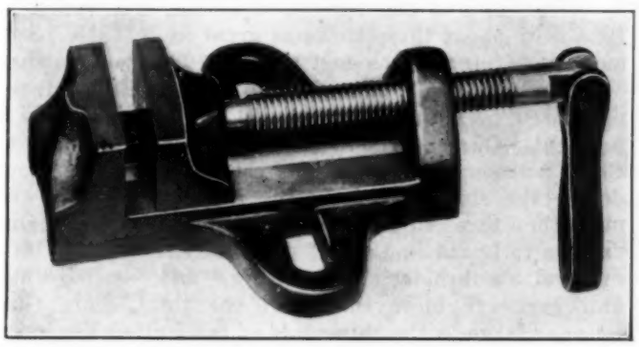
The stools have four legs each, and are of pyramid form. They are heavily braced so as to provide rigid support. They can be used individually for supporting automobile rear axles and such work, being particularly applicable in a garage. The stools are also made with a special slot at the top, for use under axles fitted with truss rods.

To form the trestle, two stools support the T-bar. Notches in the bar permit of varying the distance between the stools. Because of the fact that the device can be readily dis-sembled, the horse can be easily stored, and takes up but a small amount of space. The stools may be stacked one on top of the other. Because of the construction, their life should be practically unlimited. They are made in heights from 13½ to 30 in., the weights varying from 11 to 30 pounds.

Steel trestles with the legs riveted to the T-bar can also be supplied, when it is not necessary to have the device demountable. The standard size is 30 in. height and 42 in. length.

Austin Drilling Machine Vise

The J. L. Austin Manufacturing Co., 419 Van Buren St., Milwaukee, Wis., has recently brought out the vise shown in the accompanying illustration for use on drilling machines. The vise is intended for quickly securing small parts requiring drilling, so that such pieces are not held in place by hand. Special jigs and fixtures are not necessary for many drilling operations, because the parts can be securely held by means of the vise.



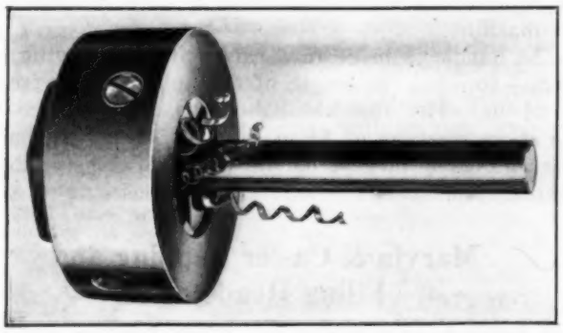
AUSTIN DRILLING MACHINE VISE

The vise is made of cast iron and intended to withstand hard usage. Two flanges on the base permit of attachment to the table of the drilling machine. The handle is so secured to the end of the operating screw that it can be swiveled to permit of operation in cramped positions. The jaws are 3 in. wide and 1½ in. deep; they open 4 in. The ¾-in. screw has an Acme thread. The weight complete is 10 pounds.

Conant & Donelson Screw Cutting Die

An addition to the line of "Reliable" two-part screw cutting dies made by Conant & Donelson, Conway, Mass., is shown in the illustration. It is made in all commercial sizes from ⅛ in. upward and fits the same collets as corresponding sizes of the regular product.

The feature of the new die is the way in which the face is ground to curl the chips ahead of itself instead of allowing them to fill and clog the clearance spaces. The manner in which this object is accomplished is by undercutting the edges in a sharp diagonal, following the principle that was long ago applied to the com-



CONANT & DONELSON SCREW CUTTING DIE

paratively well-known "gun" tap to secure the same effect when cutting internal threads.

The advantage claimed for this die is that it is a free cutting tool with less likelihood of being broken by reason of chips becoming wedged in the clearances.

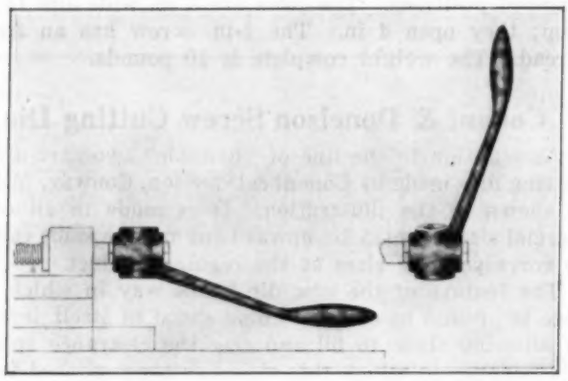
Bentley & Holmgren Vise Handle

In order to permit of quick operation in positioning the movable jaw of a screw-type milling machine vise, the B. & H. vise handle has recently been brought out by Bentley & Holmgren, 406 Court Exchange Bldg., Bridgeport, Conn. The ordinary handle placed at right-angles to the screw does not permit of quick operation, and frequently interferes with the table or some part of the setting, so that it is necessary to turn it through only a portion of a turn and then remove and replace it for the next twist. Also, it very frequently happens that the handle is permitted to strike the table at the completion of each twist, so that injury is done to the machine itself.

The B. & H. handle is a one-piece drop forging, and casehardened. It has two square holes at right-angles to each other in the boss. The handle is so positioned in relation to the boss that when it is applied in one position, as shown at the left of the accompanying illustration, it swings clear of the table and can be rapidly revolved. Applied in the other position, as shown at the right, it gives a long lever that permits of tightening the screw.

It is stated that an adjustment of 2 in. of the vise

jaw that may normally require 40 sec. with a handle at right-angles to the screw can be performed in 3 sec. When the handle is not in use, it is fastened in the first-mentioned position, so that there is no danger of



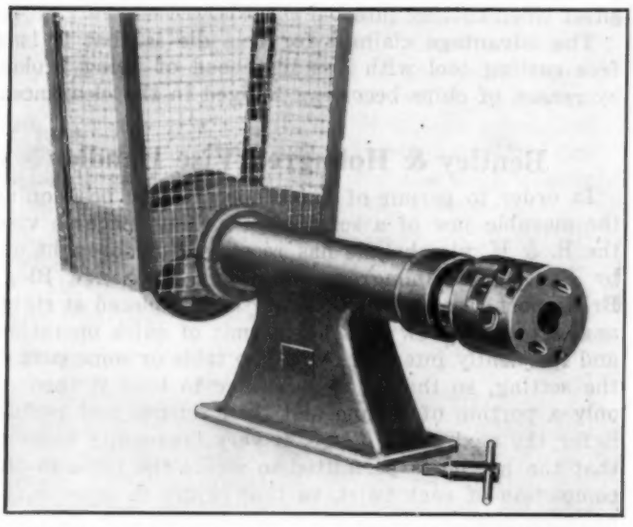
BENTLEY & HOLMGREN VISE HANDLE

its interfering with the cutter or the movements of the machine.

The handle is made in a range of sizes having holes from $\frac{1}{2}$ to $\frac{7}{8}$ in., the length of the hubs varying from $1\frac{1}{4}$ to $2\frac{1}{4}$ in. The smallest handle has a clearance with the short leverage of $1\frac{1}{4}$ in., and of 5 in. with the long leverage. The largest handle has clearances of $2\frac{7}{8}$ and $9\frac{1}{2}$ in., respectively.

Marvin & Casler Lapping and Filing Headstock

A lathe headstock for use when lapping and filing small parts has recently been brought out by the Marvin & Casler Co., Canastota, N. Y. The accompanying



MARVIN & CASLER LAPPING AND FILING HEADSTOCK

illustration shows the device equipped with a guard for the driving belt.

The tool is fitted with ball bearings at each end of the spindle. It is intended for use in lapping small holes, so as to take the work from a more expensive lathe. It may be equipped either with a twin-screw drill chuck or a three-jaw chuck. The base of the headstock is $10\frac{3}{4}$ in. long, and the distance from the pulley to the drill chuck is $14\frac{3}{8}$ inches.

Pocket-Knife Standardization

What has been done toward standardization of designs in the pocket-knife industry is shown by the following paragraphs from a report of a trade association in that industry. The saving effected might well influence other industries to follow the example particularly in lines that are as many and varied as pocket knives.

"When our industry was called on by the War Board to eliminate all unnecessary patterns and reduce our line to a minimum, a committee was selected from our industry to adopt a certain number of standard patterns and request all manufacturers to discontinue the producing of anything other than these standard patterns.

"We found when we came to get into this work that some factories were producing as high as a thousand to fifteen hundred distinct styles of pocket knives. This number was reduced to one hundred basic patterns, with about three hundred styles being produced from them. This included different coverings, handles, blades, etc.

"The number of basic patterns in the American pocket-knife industry varied in the different factories from two hundred to five hundred, from which were developed styles ranging anywhere from five hundred to twenty-five hundred. This number of basic patterns has been reduced, not to exceed one hundred and not to be developed beyond three hundred. Possibly some manufacturers today are developing as high as three hundred patterns, but you can see that this is a tremendous reduction in basic patterns, as well as the number of styles developed from them."

Variations in Machinery Exports

The value of our exports of passenger automobiles dropped from $2,356,699 in 1920 to $32,803 in 1921, partly because the market was saturated, and because the total absence of good roads between the large cities confines the use of cars to the streets of a few commercial centers. Competition from Germany and other countries was largely responsible for the decrease in our exports of dyestuffs from $6,309,168 in 1920 to $763,427 in 1921, although even this figure is gratifying when we consider that we sent practically no dyestuffs to China in 1913-14.

The marked increase both in number and value in shipments of locomotives from 20, valued at $328,629, in 1913-14, to 86, valued at $3,370,510, in 1920, and to 104, worth $5,119,837, in 1921, has been the result of American selling enterprise and of the need of first-class motive power on the Chinese railways. This is only one feature in the general increase of our exports of industrial machinery to China, for which the full American figures are not yet available, but which in 1920 were about three times as great as in 1913. Still more gratifying is the fact that in 1920 we furnished 54 per cent of the total amount of industrial machinery purchased by China, while in 1911 we shipped only 9 per cent. Our exports in 1920 of textile machinery to China were more than 50 per cent of the total, about double the shipments from the United Kingdom, and more than three times as great as those of Japan. Our exports to China in 1920 of machinery, excluding agricultural, embroidering, knitting, and sewing machinery, were more than half the total, more than twice as large as the shipments of the United Kingdom, and more than three times as great as those of Japan. —*Commerce Reports.*

News Section

Price of Farm Implements Not Advancing

In a statement as to farm implements, Chairman Anderson of the Congressional Agricultural Commission which is investigating agricultural conditions says:

"We have found that the weighted average of farm implements' factory price, exclusive of power equipment and twine, shows that price to be 41 per cent above 1913; inclusive of power equipment and twine, these prices are now approximately 20 per cent above 1913. It would appear that the factory price of agricultural implements does not show price advances to such a marked degree as other commodities and that they are rapidly receding to a lower price level. In 1914 the transportation charge on agricultural implements was about 11 per cent of the selling price to the farmer, including the freight on raw material entering into the manufacture, and in 1921, it increased to 15 per cent. A reduction in freight rates on each basic commodity, such as pig iron, steel, coal coke and lumber, would assist in reducing the farmer's expense for farm implements."

Tests for Toolbits

The Bureau of Standards of the Department of Commerce has completed a series of sixty tests of one-half inch toolbits made of several grades of high-speed steel which had been subjected to various heat-treatments. The steel used was the same for each test, containing 62 per cent carbon, 3.5 per cent chromium, 15.5 per cent tungsten, and 1.6 per cent vanadium. Results, in pounds of metal cut away, are shown in the following table:

Preheating (Time for Cut 20 Min.)	Hardening (Time for Cut 5 Min.)	Lb. of Metal Cut Per Tool (4 Tools Tested.)
1,400 deg. F.	2,417 deg. F-oil	9.1
1,500 deg. F.	2,417 deg. F-oil	10.1
1,600 deg. F.	2,417 deg. F-oil	5.1
1,600 deg. F.	2,417 deg. F-water	5.1

All testing conditions were the same. The results obtained when using water as the quenching medium are about the same as when using oil for this particular case.

House Drops Dahlgren Naval Station

During consideration of the naval appropriation bill by the House, Maryland representatives were successful in eliminating appropriations, other than those for maintenance in a closed down condition, for the naval proving ground at Dahlgren, Va. The House eliminated the appropriations by a vote of 106 to 67. Maryland representatives contended that as it was a war emergency plant it should be abolished.

Sinram Re-elected

At the annual meeting of the American Gear Manufacturers' Association, held recently at Buffalo, F. W. Sinram, president of the Van Dorn & Dutton Co., of Cleveland, Ohio, was re-elected president for the ensuing year. The vice-presidents chosen are Ray Johnson and D. F. Waterman. F. D. Hamlin was re-elected secretary-treasurer. Four new members of the executive committee were elected; they are J. B. Foote, E. E. Frost, D. F. Goedke and W. H. Phillips.

International Chamber in Italy Next Year

The next general meeting of the International Chamber of Commerce will be held in Rome, Italy, the week of March 19, 1923, it was announced last week by the American section of that body. In arriving at this decision the board of directors of the International Chamber which just met in Paris, was influenced to a great extent by the possibilities of the Genoa conference.

The next meeting of the executive committee of the International Chamber will be held in Paris on May 26 and will be followed by a meeting of the board of directors on July 10. At that time it is expected that the results of the Genoa Conference will be fairly definite and plans will then be made for the next general meeting of the chamber.

Motion Pictures in Development of Foreign Trade

At a conference of manufacturers with various government representatives last week, the value of motion pictures in industry was discussed. Director Klein, of the Department of Commerce, said that 17 per cent of American manufactured mechanical machinery was exported and that motion pictures were valuable in the development of foreign trade. Director Bain, of the Bureau of Mines, spoke of the valuable results obtained by that Bureau with motion pictures in promoting safety in mining operations. A board of review was established by the two bureaus to aid manufacturers in preparing and distributing films for use in foreign markets. This board will supervise film production and advise manufacturers as to the needs of the various foreign fields.

The Patent Convention

After having reviewed the arguments for and against the revival of the Patent Convention with Germany, the State Department is understood to be inclined to revive the treaty under the authority conferred by the Senate.

Some Machine Tool Manufacturing Statistics

When the 1919 census was taken, there were 403 establishments in the United States engaged in the manufacture of machine tools. The aggregate horsepower employed in this industry is given in a special report by the Bureau of the Census, made for the Senate Finance Committee, as being 100,433. These plants employ 132 steam engines developing 20,305 hp.; 17 steam turbines, developing 6,650 hp.; 55 internal combustion engines, developing 2,249 hp.; 16 water wheels, developing 1,033 hp.; 11,408 electric motors, developing 98,817 hp.

The capital employed by concerns engaged in the manufacture of machine tools is given as being $231,039,843. Salary and wage payments in 1919 totaled $84,216,825. The value of products was $212,400,158. There were 8,519 officers, superintendents, managers and other salaried employees. The average number of wage earners employed was 53,111.

Compulsory Patent Bill To Be Re-Drafted

Such determination against compulsory working of patents was brought forward at the initial hearing on that subject that Senator Stanley determined to re-draft his bill. He expects to eliminate the five- and two-year limitations and change his bill so as to prescribe that patents shall be worked within a reasonable time, to be determined by the Commissioner of Patents.

Thomas E. Robertson, commissioner of patents, declared his unalterable opposition to a working clause, because he believes it is imperative that the patentee have a monopoly. It is necessary, he said, to encourage invention and also is necessary to make the patent readily saleable. A working clause, he declared, would discriminate greatly against the small inventor. He pointed out that the term of patents was changed from fourteen to seventeen years because it was shown that profits accrued mainly in the latter part of the term.

It was pointed out at the hearing that a large number of patents are taken out for protective purposes only during the research period. For that reason, it was held that compulsory production would have the effect of giving a body blow to all research.

Frederick P. Fish, widely known patent attorney, of Boston, and A. C. Oliphant, of the Federated American Engineering Societies, were among those who appeared against the bill.

The position of the Secretary of War and of the Ordnance Department was that the national defense is involved in the matter of patents, particularly when foreigners are not required to manufacture in this country.

The Trend of Business Improvement—Plants Resuming

The Motor Wheel Corporation has increased production to capacity at its pressed steel wheel plant at Lansing, Mich., with the adoption of night shifts in several departments at the main works. The Gier plant of the company is operating at full capacity for the first time in the past eighteen months.

The Ford Motor Co. has resumed operations at its branch plant at Atlanta, Ga., following an idle period of about a year. Employment is being given to 300 men, and this force will be increased at an early date.

The Virginia Bridge and Iron Works, Roanoke, Va., is arranging for the immediate reopening of the plant of the Birmingham Steel Corporation, Birmingham, Ala., recently purchased at a Federal receiver's sale. Different departments will be remodeled and improved, and necessary equipment installed. A large portion of the works will be adapted to railroad car repair work, and the remainder given over to structural steel fabrication for buildings and bridges.

The Lansing Foundry Co., Lansing, Mich., has adopted a full time, full production schedule, with employment of additional men. A large order has been secured for parts for the Maxwell automobile, as well as for castings for the Erd Motor Co., Saginaw, Mich.

The American Bridge Co. has resumed operations at its plant at Trenton, N. J., which has practically been closed for the past year. Employment is being given to about 200 men, and this force will be increased to a quota of from 400 to 450 by the close of May.

The Ryan-Bohn Foundry Co., Lansing, Mich., is increasing its working force of coremakers and molders, and has adopted a capacity operating schedule. The company has secured large orders for automobile engine castings for the Continental Motors Corporation.

The East Penn Foundry Co., Macungie, Pa., has increased the wages of coremakers, molders and other foundrymen, 10 per cent. Full production is being maintained under regular operating schedule.

The New York Central Railroad Co. has reopened its locomotive and car repair shops at West Albany, N. Y., Avis, Pa., and Collinwood, Ohio, giving employment to about 775 men on a piecework basis, under increased wage scale of 25 per cent. The West Albany shops will operate with 500 men, the Avis shops with 175, and the Collinwood shops with 100 men.

The Western Maryland Railway Co. is arranging for the immediate resumption of operations at its Ridgeley, W. Va., shops. Work will be devoted to the repair of steel cars. The shops at Fairfax and Elkins, Md., will also be operated.

The Atlas Drop Forge Co., Lansing, Mich., has adopted an overtime schedule in a number of departments at its plant. Operations are on a capacity basis throughout the works, and orders on hand insure production at this rate for a number of months to come.

The Ames Shovel and Tool Co. has resumed operations at its Elwood, Ind., plant, giving employment to about 300 men.

The Willys-Overland Co., Toledo, Ohio, has increased production at its plant, with operations on a basis of 500 automobiles a day. April sales have broken previous records.

The Galveston, Harrisburg & San Antonio Railroad Co. is increasing operations at its car and locomotive shops at El Paso, Tex., and has authorized an immediate call for bids for the construction of a new machine shop at this works, to cost about $200,000, including equipment.

The Hayes-Ionia Co., Ionia, Mich., manufacturer of automobile bodies, has reopened its plant for the manufacture of bodies for the Olds and Reo automobiles, following a shut down for several months past. Employment will be given to about 300 men.

The Hendee Manufacturing Co., Springfield, Mass., manufacturer of motorcycles, has adopted an overtime schedule in two departments, and is increasing the working force throughout the plant. April production ran to 1,400 machines, or more than double the output of January and February.

For several weeks past the Stewart-Warner Speedometer Corporation, Chicago, Ill., has added to its working force at the rate of from 250 to 300 employees a week. Operations have been increased over 300 per cent as compared with this time a year ago. Manufacture is commencing on a number of new automobile specialties, including spotlights and gasoline meters.

The Continental Motors Corporation has adopted a night shift of 500 men at its plant at Muskegon, Mich., working on a large order for motors for the Durant Motor Co. Operations are being advanced at the Detroit plant, which is now giving employment to 1,800 men, or 50 per cent more than at this same time a year ago.

The McCord Manufacturing Co., Chicago, Ill., manufacturer of automobile radiators, gaskets, etc., is increasing production at its Racine, Wis., plant, and will place a full time, full capacity schedule in operation early in May. Manufacture is also being advanced at other plants of the company.

The American Car and Foundry Co. is advancing the production schedule and increasing the working force at its plant at Jeffersonville, Ind. Orders on hand insure continuous operation for the balance of the year. Recent assignments for the plant include 24 cars for the Louisville & Nashville Railroad; 15 cars for the Interstate Public Service Co., Indianapolis; 50 cars for the Chicago & Northwestern Railroad; and repairs to 25 passenger cars for the New York Central Lines.

The Duplex Printing Press Co., Battle Creek, Mich., is increasing operations at its plant and plans for early enlargements for greater capacity. It is proposed to double the present facilities of the foundry and machine shop, and about $750,000 will be expended for buildings and equipment. The line of production will be extended to include printing presses and parts for catalog and magazine work.

C. A. McCune New President of Welding Society

The annual meeting of the American Welding Society was held in the Engineering Societies Building, New York City, from April 26 to 29. The program included the reading of papers on welding and related subjects, and a series of discussions on the adoption of standard specifications and codes. At the technical session of the meeting three interesting papers were read. They were: "Welding of Heavy Copper Plate," by A. S. Kinsey; "Electric Welding of Dredge Pipes," by J. H. Nead and R. L. Kenyon; "Thermit Welding," by J. H. Deppeler. Separate sessions were held on electric-arc and gas welding. The committee on training of operators reported considerable progress along these lines and was authorized to continue its work during the next year.

The election of officers resulted in the selection of Charles A. McCune, of the Page Steel and Wire Co., Bridgeport, Conn., as president; W. H. Namack, of Ballston Spa., N. Y., vice-president for the New York and New England district; T. T. Oechsle, Philadelphia, Pa., vice-president for the middle Eastern district; W. A. Slack, Chicago, vice-president for the middle Western district. Directors elected were: James Burke, Erie, Pa.; Herman Lemp, Erie, Pa.; H. I. Walsh, Newport News, Va.; A. F. Jenkins, Baltimore, Md.

In recognition of his services to the welding industry and to the society, the members elected Comfort A. Adams to honorary membership in the American Welding Society. Mr. Adams was the founder of this society and has been instrumental in bringing it to its present state of success. The society also conferred this honor upon Edmond Fouché, of Paris, who is credited with being the first to see the possibilities of gas-torch welding.

N. Y. State Scholarships for Technologists

The University of the State of New York is offering twenty-five scholarships to trade and technically trained persons who desire to prepare themselves for teaching. Persons selected to hold these scholarships, who satisfactorily complete the prescribed one-year industrial teacher training course, are licensed for life to teach their specific occupations in the vocational schools of the State. The salaries range from $1,800 to $3,500 per year. Applications can be obtained from the Division of Vocational and Extension Education, State Department of Education, Albany, N. Y.

Applicants for appointment to the industrial teachers' scholarship must possess some of the following qualifications: Trade, industrial or technical experience; a good general education; must be of good moral character, possess good health, and be a citizen of the United States.

The twenty-five scholarships which will be awarded to qualified persons in 1922 are distributed among the electrical, machine shop, automobile repairing, machine drafting and designing, architectural drafting, printing, textile working and a few other trades.

Business Conditions in England

BY OUR LONDON CORRESPONDENT

Were it not for the unfortunate dispute between employer and employed in the engineering industry, it would be possible to report a marked improvement in conditions economic and industrial. During the past few weeks London has been steadily growing more cheerful, and such headings as "industrials firm," "rubber brighter," "oils rising," "mines more active," and so on, have been fairly common in the financial journals. Money is plentiful and gilt-edged securities have appreciated markedly. To take an outstanding example, the 5 per cent war loan, issued at 95 and for a long time well below that figure, has lately risen to 100. Of course there is a reverse side, as cheaper money suggests bad trade and consequent restriction of the ordinary avenues of investment. Anyway, money is cheaper and this fact and the reduction offered during the course of months in the floating debt have caused the value of gilt-edged securities to rise. It was anticipated with confidence a week or two ago that the bank rate would be lowered to 4 per cent; even now it is held that the reduction is merely postponed for a short time. But in this matter New York sets the fashion and the bank rate here follows.

Imports and Exports Gain

The returns of overseas trading during March showed in imports (total £87,879,424) an increase of 18½ million pounds as compared with the previous month, though more than 5¾ millions less than March of last year. Similarly, British and Irish exports (total £64,580,793) showed an increase of about 6¼ millions over the previous month, but about 2¼ million pounds less than March, 1921. Re-exported goods (total £10,153,612) were at about the same value as the previous month, and about 1¼ millions more than in March, 1921.

That conditions are improving is shown by the steady decline in the numbers of unemployed officially registered. The fall is more than 192,000 in the last twelve weeks. But here the engineering dispute is beginning to have effect, though the men locked out are not registered as unemployed or they would swamp the improvement. We still have some 1,742,517 persons officially known to be out of work, excluding work-people on short time. Lancashire has been negotiating for some time over a reduction in wages and meanwhile reports less unemployment than for months, while generally speaking the business outlook is regarded as brighter. More people are being employed in coal mining; here the unemployed percentage is among the lowest in the manufacturing and producing industries. In the iron and steel trades the engineering dispute blocks progress where a steady expansion had been anticipated. It is to be understood that in engineering generally not all the shops are closed; those firms that are outside the employers federation are still running, and in the others, pending negotiations, the lockout notices to semi- and un-skilled workers are postponed.

The electrical side of engineering remains fairly well employed, and this is true of textile machinists, though in the process of time the pressure has eased somewhat. The locomotive shops are dull, but, while orders for British lines are still in abeyance, it is publicly stated that contracts with Roumania to the extent of £5,000,000 are being negotiated, though how the financial problems attendant are to be solved has not been made clear. As to motor car firms, those on the light side remain the better employed, in fact the popularity of the light car increases.

The flying machine side of affairs has lately been given an impetus by the increase in the commercial services, particularly between London and Paris. But the unfortunate collision in France has acted as a damper. To revive our spirits and increase confidence we are being reminded that from the beginning of civil aviation in 1919 to the end of last September, according to the Air Ministry, only twelve persons were killed out of 142,241 passengers carried by air; in fact until this last accident there has been no injury in the British services for more than twelve months.

Llyod's Register returns for the last quarter show that we have about 2,236,000 tons of shipping under construction; a reduction in the quarter of about 404,000 tons: deducting vessels on which work has been suspended, apart from the shipbuilding workers' wage dispute, the tonnage actually under construction amounts to about 1,443,000 tons, the decrease applying to most countries.

At the final accounting the national revenue for the year ending with March last showed a balance over expenditure of about 46 million pounds, the revenue amounting to £1,124,879,873 and expenditure to £1,079,186,637. The surplus was considerably below the sum estimated originally, expenditure having been swollen in various supplementary ways, not foreseen when the budget was introduced. Again, the surplus is not entirely due to taxation, for the special receipts amount to more than 170 millions, partly received from Germany on account of the army of occupation and largely arising from the sale of government stores, which, even if properly regarded as revenue, which is doubtful, cannot be repeated next year.

Electric Industry Booming

The war undoubtedly set a number of engineering concerns on their feet again, this applying to mechanical engineers who were able to adapt themselves to the requirements of the moment. The effect on the heavier electrical side was very evident. Here Great Britian had a considerable number of firms none of whom were able to pay large profits, at any rate before the war. Now most of them appear to be in a stable condition, with credits beyond anything they were accustomed to in the past. Thus the Brush Electrical Engineering Co., which has of late been a good customer to machine tool firms for fairly heavy tools needed in the construction of the Ljungstrom steam turbine, at its latest meeting reported a profit, after deducting debenture interest, management expenses and maintenance but not depreciation of £230,557, an increase on the year of about £41,500. Metropolitan-Vickers Electrical Co., formerly known as the British Westinghouse Co., made a profit of £440,300, or about $38,000 greater than was reported for the last year. Stock of materials in hand, work, etc. in progress (less receipts on account) are estimated at just short of two million pounds, comparing with more than 2¾ millions in 1920.

The 1921 outputs were records, both for the Brush and the Metropolitan-Vickers Co. The Edinburgh firm of Bruce, Peebles & Co. paid 15 per cent, and Mather & Platt, Ltd., which is concerned with machinery for the textile industry, paid the same dividend as a year ago but carried forward a larger sum. Other electrical concerns might be noted as paying good dividends, and the cable companies have done well. But there is one marked exception in the electrical field, namely the Edison-Swan Co., which reports a loss of £344,730, for which the coal strike last year is held to be largely responsible. It may be added that £346,445 has been written off for depreciation of stock, and this item in itself more than accounts for the loss.

Some Profits Lower

Turning to the larger mechanical engineering firms, the balance sheet of Cammell, Laird & Co., Birkenhead, Sheffield, etc., indicates a net profit for last year of £170,487; this is more than £90,000 lower than the net profit for the year previous and about £132,500 less than the net profit for 1919. According to the present balance sheet the stock in trade and work in progress are valued at £1,691,148, or not much more than half the corresponding figure at the end of 1920. Armstrong, Whitworth & Co., Ltd., paid 5 per cent on last year's business compared with 10 per cent the year previous; and Craven Bros., South Reddish, makers of machine tools and cranes, paid 7½ per cent on ordinary shares last year.

The prospects of engineering as a sectional interest have certainly been improved as the result of the operations of the Trade Facilities Act, under which the government gives guarantees to enable development schemes to be undertaken. London will benefit by the establishment of a ship-repairing works, etc., on the Thames, by Harland & Wolff, Ltd., nearly 1½ millions having been guaranteed to the firm for this purpose and for certain constructional work in the Glasgow area. Then five millions, repayable as the principal and interest over fifty years, will be devoted to the enlargement of the South London tube, the first of the underground electric railways, and to an extension of another London line. Also 6½ millions for 25 years will be available for the electrification of suburban sections of one of the main London railway lines. Sums have been made available for an electrical generating plant for India and certain English districts, and shipbuilding, steam engineering, dock and harbor work, sewage systems, quarries and the manufacture of folding boxes, all are to benefit.

Detroit Letter

Unemployment in the industrial plants of Detroit seems to be at an end. The Employers' Association has estimated that 45,000 men have been put back to work since October of last year. The latest returns show that about 4,500 men were re-employed during the week ending April 18. Most of the firms are working on full time. There seems to be a shortage of skilled workers.

Inquiries of quality are more generally active in this city than they have been for some time past. An encouraging number of orders has been placed and one dealer said that if he does as well during the next three-fourths of 1922 as he has during the first quarter, his sales will equal in volume the best pre-war year. This does not mean, however, that as many machines have been sold, because prices are higher. Nor does it mean that as much profit has been made, because a much larger organization has done the selling. The sales office is larger and expenses are larger in proportion. The outlook is that sales will be even better during the remainder of the year.

Sales now being made indicate that manufacturers are looking for machines that will cut production costs. Standard machines seem to have a better market. Another large manufacturer of machine tools reports that February was better than any one of the fourteen months preceding and that March was better than February. The outlook for April, so far, shows a further increase. In making this statement the manufacturer referred only to small tools and gages, but added that they are a good barometer and presage similar improvement in larger tools. At any rate they show current activities that could not be construed in any but a favorable light.

The stimulating effect of the radio craze during the past three months has been directly productive of sales. Manufacturers of radio apparatus are all working their plants on double shifts and still cannot fill orders which continue to pour in. Detroit seems to have become overnight the hub of radio activities in the United States.

Syracuse and Buffalo Letter

There seems to be no question as to business having turned the corner and being on the up grade. In Syracuse, for example, every machinery man agrees that business is decidedly better than it was. This is not false optimism, but the calm judgment of hard-headed business men who have fought their way through the past two years.

Machine supplies are in greater demand, showing that they are being used up; also that small dealers are replenishing stocks. Machine builders find more demand for repair parts, indicating that machines are being used once more. Each month shows an improvement over the previous one.

One interesting case is that of the Carhart Bros. foundry. This company took hold of a business just as the slump hit its worst blow and many feared disaster. But the firm brought an experience from a bigger business which helped it weather the storm and come through with flying colors.

The managers prepared an advertising campaign in the local papers and stuck to it persistently and continuously. They varied the spaces from a quarter page down, in the best daily—for it is a local business. But every issue kept the users of castings in and around Syracuse informed as to where they could get good castings. And the company got orders. Other methods of publicity were also used and the total net result is to find Carhart Bros. firmly established and looking forward to the gradually improving business conditions with a smile. It is worthing thinking over.

Buffalo has a number of bright spots in the way of business revival. The American Radiator Co. is very busy as a result of building activities. The Federal Telegraph and Telephone Co. is busy in common with other manufacturers of radio apparatus.

Perhaps the best positive proof of improved conditions is the discontinuation of the form of relief known as the bread line—which had been necessary up to the present. Another sure sign is the fact that men are in demand, good tool makers and others being hard to find. The Pierce-Arrow Motor Co. is included in the general improvement, although handicapped by the effects of a recent regime of efficiency management experts who left a trail of heavy deficits for the year 1921.

The industries which have to do with railway equipment are improving decidedly. Pratt & Letchworth and others report more orders and greater efficiency in operation. They are very sanguine as to the future of 1922.

Cincinnati Letter

The machine tool and general machinery business in Cincinnati seems to be looking up. Orders are being received by local plants from all parts of the country. One manufacturer reports that he has received a number of orders by wire, which indicates to him that shops are in need of certain classes of equipment and that they are in a great hurry to supply the demand for their product. A foundry supply concern reports that the business for the first three months of this year was 30 per cent greater than for the same period in 1921. The Fulflo Specialties Co., of Blanchester, reports that business is very good and that it has received an order from a large automobile manufacturer for a quantity of pumps. R. K. LeBlond has become the head of a realty corporation that will finance the construction of buildings for industrial purposes. The organization is capitalized at $1,000,000. Part of the assets will be the land and buildings on Reading Road and Morgan St., which is now occupied in part by the De Haven Ice Cream Co.; another tract will be the holding at Fourth and Sycamore Sts., to be occupied in part by the Southern Railroad Company's offices.

The factories across the river, which have been guarded by troops during the last three months while the strike of employees was in progress, are reporting that they are continually taking on more help and that several new departments have been started. It is intimated that the militia will soon be withdrawn. Employment in the machinery trade is improving, as the daily papers have carried advertisements at various times during the week for machinists and skilled workers.

Chicago Letter

The change that has taken place in the local machine tool market is not merely one of sentiment but a number of orders have actually been booked. It is true that sales are still relatively insignificant and greatly outnumbered by inquiries and this is one of the things which has made the sentiment more optimistic. There is also a feeling that much progress is being made in the direction of an industrial revival, shown strongly in the building industry, and that it is only a question of time when increased shop activities will be felt in purchases of equipment. Many local shops have already increased their working percentage and several of them find a scarcity of labor. This is particularly noticed in the vicinity of steel plants in this district and also in the building industry.

Several of the machine tool dealers report a few fairly good size orders, but in general the orders booked are small, principally for single machines. The demand is widespread and there is a noticeable improvement in collections.

The Santa Fe Railroad has again made additional inquiries and has placed a few orders for new equipment. The other railroads are still among the expectations of the tool dealers. Activities, after a dull period of a few weeks, are again in evidence in the railroad car buying. The Wabash has contracted for approximately $1,000,000 worth of new passenger equipment, including twenty-four all steel passenger cars, the latest type and design, consisting of eight coaches, nine chair cars, four dining cars and two club chair cars. The American Car and Foundry Co. has the contract for the construction of the equipment. It is understood that equipment purchases aggregating approximately $3,250,000 is to be made within the next few weeks by the Northern Pacific Railway Co.

Judge E. H. Gary, chairman of the board of directors of the United States Steel Corporation, recently made an announcement that a $15,000,000 plant for the manufacture of lap and butt weld tubes is to be erected at Gary, Ind., by the National Tube Co., a subsidiary of the steel corporation.

Birmingham Letter

The consensus of opinion among Birmingham manufacturers seems to be that business is improving. The steel plants and other manufacturing establishments are fairly busy, though not running up to capacity. The most important event here during the week was the convention of the Southern Supply and Machinery Dealers Association. Several hundred dealers and manufacturers of mill supplies were in attendance and all expressed optimism in the future of Southern industries.

The Walraven Co., at Atlanta, agents for Brown & Sharpe, Hendey, Bullard, Gray, Heald, and a few others, report business quiet but are making some sales of tools to railroad shops and garages. They report that there is a slight improvement, and that the majority of good second-hand tools has been worked off. The Seeger Machinery Co., Atlanta, reports that its sales are equal to those of 1913-14. This concern is the agent for Cincinnati milling machines and for Landis grinders.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
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Prof. Lionel D. Edie of Colgate University recently published a book called "Principles of the New Economics" that ought to be read by all business men. In the first chapter upon "The Significance of Psychology in Economics" he says, "Men are bundles of tendencies to act. Whether in the banker's office or around the directors' table or on the salesman's route or at the worker's machine, men are aggregates of urges to act in certain directions."

The truth of this statement was aptly exemplified in the financial markets last week. There is hardly a precedent in peace times for the concatenation of disturbing events that business had to face.

With Lloyd George predicting that war might be a consequence, the disruption of the Genoa Conference more than once seemed imminent. A bonus bill that will sooner or later involve the distribution of four or five billion dollars among our ex-soldiers seemed more certain of passage than at any time previously. No progress toward the settlement of the coal strike was made and from New England it was reported that some of the textile strikers were resorting to bomb throwing and sabotage.

In China three military leaders are contending for the mastery of the country and an internecine war is threatening.

Floods in the Mississippi Valley and Texas have already caused much loss and unseasonable weather has delayed agricultural work throughout the country.

Speculation Rife

None of these things nor the warning against the excessive use of credit for speculative purposes, issued by the Comptroller of the Currency, Mr. Crissinger, seem to have had the slightest effect upon the "urge" to invest or buy something by which so many men now seem possessed. On Tuesday last new bond issues amounting to over $186,000,000 were offered and sold in the New York market. They included $45,000,000 New York City bonds which were bought on a 4.12 per cent basis and are being resold to the public at a price which yields only 4.06 per cent.

Total offerings for the week were probably in excess of $300,000,000 and many other large issues are being planned for. Liberty Bonds have moved upward again to a parity with the basis upon which the New York City bonds were sold and most other securities upon which a fixed return is assured have been correspondingly firm.

This extraordinary demand for investments is, of course, primarily due to the ease of money, but it also reflects a widespread confidence in the future that is the more impressive because it refuses to be shaken by untoward developments that would be almost paralizing if the psychological attitude of the community was less stubbornly optimistic than it is.

This being the case it is reasonable to assume that the upward movement will re-assert itself whenever the influences which now restrain it cease to be operative and as strikes must ultimately be settled and order has always been brought out of disorder in the past the probabilities seem to indicate that the "urge" to buy will outweigh the desire to sell for some time yet. The result will be rising prices, for the market tendency is frequently determined by a very slight preponderance of demand or offerings and in the present case it seems likely that with any encouragement the buyers will largely outnumber the sellers.

Gold Reserve Gains

This view is reinforced by the statement of the Federal Reserve System which shows a further addition of $4,300,000 to the gold held and a gain of 1 per cent in the reserve ratio which now stands at 78.3 per cent. This is all the more surprising as most stock brokers are increasing their loans and the only explanation suggested is that merchants are borrowing less because they are allowing their stocks to run down. If this be true the jobbers' trade should soon be better, for the money realized from the tremendous bond issues recently sold must soon find its way into circulation and increase the purchasing power of the wage earners.

From Youngstown, Hammond and other steel manufacturing centers it is reported that "Help Wanted" notices are to be seen for the first time in many months, and except in the coal mines and cotton mills there is certainly less unemployment than there was. In the building trade, which is becoming exceptionally active everywhere, there is a great scarcity of skilled mechanics, and in New York contractors are outbidding the union wage scale.

The commodity markets show but few important changes. Cotton has been somewhat firmer on the flood news but overflow years are not as a rule short crop years and those who were counting upon a comparatively small gain in acreage have been slightly shocked by a private estimate which puts the increase at 19 per cent. Confidence in an enlarged export demand for cotton has also been somewhat disturbed by developments at Genoa. The other textiles, wool, silk, flax and jute, have been firm, though trading is somewhat restrained by tariff uncertainties.

Sterling exchange has been remarkably steady despite the turbulence at Genoa, but francs and lire have been rather easier and marks went back to 35 cents a 100 after having advanced to 43 cents upon the theory that Mr. Morgan's promised attendance at a financial conference to be held in Europe meant that he would undertake to float a German loan here. Such a loan might find a few buyers here but it is to be doubted whether it would be generally taken.

The stock market has not been quite as strong as the bond market and in the industrial department some declines have been registered from time to time, but railroad shares have not yielded appreciably. The Lake Erie & Western Railroad, formerly owned by the New York Central, has been sold to interests which recently purchased the Toledo, St. Louis & Western, and the Interstate Commerce Commission has arranged for an open conference at which the railroad executives will have opportunity to discuss the consolidations for which the Esch-Cummins bill provides. These are but precursors of the many railway combinations that are believed by some to be inevitable and in their consideration many properties are likely to develop elements of value not previously discerned.

Economy Necessary

The result may be a great speculative movement in the railway stocks which represent the control of our greatest industry and if it does the resulting increase in their asset value will so enlarge the basis of credit that a marked expansion of business generally will be almost certain to follow.

But we must not deceive ourselves. It is upon psychological rather than material conditions that we must rely for the stimulated activity that seems to be ahead of us. Real prosperity is the product of hard work and political as well as individual economy. Until Congress appreciates the truth of this aphorism and applies it wise men will watch carefully for any signs of change in the prevailing sentiment.

It is to be admitted that there is but little indication of any change as yet, for the possibilities of "gold inflation" which have been so frequently pointed out in these letters are now beginning to dawn upon the popular mind. As an example of this one financial writer has recently stated that an aggregate expansion of about four billion dollars in the loans and circulation of the Federal Reserve Banks is now possible without reducing the reserve ratio below the 40 per cent which is generally and erroneously assumed to be the legal minimum. The calculation is probably misleading but it has powerfully impressed the public imagination and may ultimately give currency to the idea that credit is inexhaustible, which is one of the dangerous hallucinations by which men become obsessed in times of speculative excitement.

Industrial Engineers Hold Eighth Convention in Detroit

The eighth national convention of the Society of Industrial Engineers was held in the Hotel Statler, Detroit, Mich., April 26 to 28. The major subject of the meeting was "The Influence of Industrial Engineering Upon the Earnings of Capital and Labor." The meetings were held in the afternoons and evenings; the mornings were devoted to inspection trips to several of the large manufacturing plants in Detroit and nearby cities. Some of the plants visited were: Ford Motor Co., Detroit Steel Castings Co., Cadillac Motor Car Co., Detroit Pressed Steel Co., Burroughs Adding Machine Co. and the Hudson Motor Car Co. Joseph W. Roe, president of the society, presided over the technical sessions.

The meeting on Wednesday evening was presided over by Mortimer E. Cooley, president of the F. A. E. S. and Dean of the College of Engineering, University of Michigan. E. W. Hulet, vice-president of the White Motor Co., Cleveland, talked on "How Industrial Engineering May Serve the Executive," and illustrated his remarks with lantern slides.

"How Industrial Engineering Serves the Factory Manager," by Carl Wennerlund, of Detroit, introduced some new phases of industrial management. Mr. Wennerlund traced the development of industrial engineering during the past few years and interpreted its influence on industry. His remarks covered the progress of factory staff duties, tool designing, strengthening of belting and machines, speeding up of line shafts and an increase of bearing areas. In speaking of wage incentives whereby workmen would be promoted in proportion to their productive capacities, he said that it had been found advantageous to handle production so that a workman's efforts would be coordinated to the best advantage of all concerned. After much of the purely physical work in factories had been done it was clear that some attention should be paid to the human element. He advocated the selection of employees with some view as to their moral, physical and vocational fitness. The great influence of the industrial engineer lies in the fact that he has taken one subject, thoroughly analyzed it, and has pointed out certain methods of procedure in order that better production could be obtained. This led to the development of that great subject known as "motion study" which has become the basis for setting wage incentives and which has been adopted in principle by manufacturing concerns everywhere. Mr. Wennerlund followed these remarks with a résumé of methods by which every class of work done in the General Motors plants is in charge of an expert, and all these activities are tied together under one staff director, so that all can co-ordinate in and follow the same policy.

Fred M. Sawin, of the Federal Rubber Co., offered some added suggestions to the above remarks. He explained a plan whereby each general foreman, foreman, and assistant foreman receives, in addition to his regular salary, a bonus based on the following factors: percentage of seconds; cost of repairs to product; percentage of waste; departmental unit cost of product; amount of power used and direct overhead cost. He said that in the first year in which this plan was used the saving over the previous year amounted to over $400,000.

At another session Robert B. Locke, director and manager of the Federal Reserve Bank, Detroit, spoke on "The Need of the Hour." In the course of his remarks he said: "No sense of justice can be expected in working men until they are drilled in the fundamental economic principles underlying all business relations. The most drastic statutes will not cure the strike plague, but widespread instruction in economics will. This is an age of propaganda; many of us are unaware of its tendencies or its magnitude. A great deal of it is founded on economic fallacy. Therefore, I repeat that business should take an active interest in the character of today's tidal wave of propaganda.

Progress From Toil

"To stem the tide of discontent there is necessary a campaign of education, which will show the rising generation that America has gained everything that revolution can possibly bring, that there are certain boundaries beyond which the race cannot pass, and immutable laws of economics which no radical upheaval can alter. Neither the idle rich nor the shiftless poor can make secure the future of any state. Progress must come from those who toil intelligently and who receive therefrom character-building development. It is this class that gives to democracy the best guarantee of safety, and this class must not be oppressed either from above or below."

Dr. Yoichi Uyeno, chief director of the Institute of Industrial Psychology, Tokyo, Japan, told of his experience in applying scientific management in the factories of Japan. He said that after thorough research the hours of work were reduced and rest periods made available to the workers in the forenoon and afternoon. Working on the theory that every individual has a natural rate of speed, workers were arranged in groups in which members all worked at approximately the same rate of speed. This developed the instinct of rivalry between groups and resulted in an increased production of 35 per cent.

Henry C. Link, author and employment psychologist, started a heated discussion when he declared that "Judging a man by his face or his handwriting is nonsense." This remark was taken up by Harrington Emerson, of New York, who characterized Mr. Link's remark as "absurd." Mr. Emerson's views were supported by John Calder, superintendent of industrial relations, Swift & Co., Chicago. Mr. Calder went into considerable detail in justifying his stand on the question. He related some of his experiences with help in the packing plants of the Swift company.

Other speakers were: E. T. Miller, United Typothetae of America; W. W. Gilgis, the Palmolive Co.; W. P. Hilton, Willys-Overland Co.; Mathew Woll, vice-president of the American Federation of Labor; L. Morehouse, Detroit Pressed Steel Co.; F. H. Lowe, Ford Motor Co.; A. S. Cunningham, Hadfield-Penfield Steel Co.; Sam Lewisohn, of New York; F. B. Gilbreth, of Montclair, N. J.; N. A. Hawkins, of Detroit; and D. B. Gauschet, of Chicago.

Esthonia a Market for American Agricultural Machinery

Esthonia is a country which is well worth the careful attention of American manufacturers and exporters of agricultural machinery. It is primarily an agricultural country, and over two-thirds of its population are dependent on agriculture for a livelihood. The farmers are generally of a high degree of literacy and intelligent and progressive. There are sixteen agricultural schools in the country, which serve to spread broadcast knowledge and understanding of modern methods of farming. The numerous agricultural societies which exist in Esthonia have also had much to do with spreading the knowledge of modern agriculture possessed by the farmers, and for the past decade, through local farmers' associations, numbering 130, the use of fertilizers, agricultural machinery, and other things of economic value has become general.

A serious lack of agricultural machines exists in the country at the present time. This has resulted from the stoppage of imports during the war and during the period of reorganization following the war.

A. S. M. E. To Consider Power Test Codes

On Tuesday morning of the spring meeting of the American Society of Mechanical Engineers (Atlanta, Ga., May 8 to 12) a public hearing is set for the discussion of the three additional power test codes which have reached this stage of their development during the past year. Last May at Chicago the committee, of which Fred R. Low is chairman, presented codes on general instructions, steam engines, and evaporating apparatus. It now presents codes on definitions and values, displacement compressors and blowers, and hydraulic power plants.

Though these codes have passed six successive revisions in reaching their present form, the committee will welcome a full and frank discussion by the members of the society and others interested in these subjects. Reprints of all three codes, revised to date, have been prepared by the committee and may be obtained by addressing C. B. LePage, secretary, at the society's headquarters.

Adams Demonstration in June

The third annual machinery demonstration by Ogden R. Adams, Central Ave. at St. Paul St., Rochester, N. Y., will be held on Friday and Saturday, June 2 and 3. This year two days will be given to the demonstration which promises to be on a larger and more diversified scale than heretofore. Manufacturers and technical experts from various parts of the country will be present to demonstrate their products. Other unusual and interesting features will be presented to make the two days most helpful and entertaining to all who attend.

Professor Moore Explains Latest Theory on Endurance of Steel

At a meeting of the New York chapter of the American Society for Steel Treating, held in that city on April 25, Prof. F. H. Moore delivered a lecture on the "Fatigue of Metals." The material for the lecture was taken from a bulletin of the Engineering Experiment Station of the University of Illinois, of which Professor Moore is in charge, and was supplemented by some later developments along the lines suggested in the title.

Professor Moore spoke extemporaneously, giving some interesting details of his recent experiments to establish an endurance limit for steel. His conclusions showed there was a very definite endurance limit for different kinds of steel, subject to stresses of varying magnitude applied under certain conditions. The discussion which followed the professor's address brought out some interesting thought. Further developments along these lines are expected at future meetings of the society.

Steel Treaters Spring Meeting in Pittsburgh

The annual spring meeting of the American Society for Steel Treating will be held in Pittsburgh on May 25 and 26. W. J. Merten, chairman of the meetings committee of the Pittsburgh Chapter of the association, is in charge of the arrangements and has announced a tentative program which embodies some very interesting sessions. The papers which will be presented have been selected from a large assortment of subjects pertinent to the steel treating industry. Some of the papers are: "Fiber in Steel and Iron," by Prof. McIntosh, of the Carnegie Institute of Technology; "Mass Influence on Heat-Treating," by W. D. Crowe, of the Carnegie Steel Co.; "Abrasive Qualities of Carbon in Alloy Steels," by Mr. Cox, of the R. D. Nuttall Co.; "The Importance of Properly Heating and Cooling Steel," by J. A. Succop, of the Heppenstall Forge and Knife Co.; "The Manufacture of Springs," by Mr. Smith, of the Union Spring & Manufacturing Co.; "Shrinkage of High Speed Steel," by Mr. Grossman, of the Electric Alloy Steel Company.

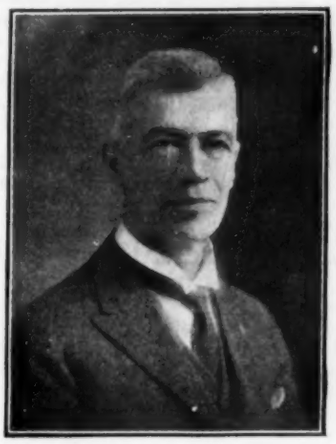
At the annual banquet, which will be held on the evening of the twenty-fifth, the toastmaster will be G. H. Neilson, president of the Braeburn Steel Co. The speakers will be Dr. Bowman, of the University of Pittsburgh; Dr. J. A. Matthews, president of the Crucible Steel Company of America; and Prof. F. Crabtree, chairman of the American Institute of Mining and Metallurgical Engineers, Pittsburgh Division. The theme of the speakers at the banquet will be "Mystery of Metallography and the Heat-Treatment of Iron and Steel." A series of expeditions to the various plants in the vicinity of Pittsburgh has been arranged. The delegates will visit the steel mills and manufacturing plants and will be entertained by the management of several plants in the city.

The meetings will be held in the Auditorium of the Bureau of Mines and the headquarters of the convention will be established there. Further particulars regarding the convention can be had from W. H. Eisenman, national secretary of the society at 4600 Prospect Ave., Cleveland, Ohio.

W. A. Greaves, Machine Tool Builder, Dies in Cincinnati

William A. Greaves, Sr., president of the Greaves Machine Tool Co., Cincinnati, Ohio, died in that city on April 19. He was sixty years old. Mr. Greaves was well known in the machinery building industry.

He was born in Cincinnati and obtained his technical education in the Ohio Mechanics Institute. He served



WILLIAM A. GREAVES, SR.

his apprenticeship with the Lomas Forge and Bridge Co., in Cincinnati, and later became a foreman for Lodge, Barker & Co.

In 1889 he formed a partnership with H. H. Klusman, which was known as the Greaves-Klusman Co. His company manufactured lathes and wood-working machinery. In 1914 the company was incorporated as the Greaves-Klusman Tool Co., and took up the manufacture of lathes exclusively. Mr. Greaves sold out his interest in this concern in 1917, and with his two sons formed a partnership which is now known as the Greaves Machine Tool Co. He was also president of the Western Water Motor Co.

Mr. Greaves had a pleasing personality, and his vocal talent made him a welcome visitor in the social and business circles in which he moved.

Office Managers' Conference

The third national conference of the National Association of Office Managers will be held at Washington, D. C., on May 18, 19 and 20. Headquarters will be in the Hotel Raleigh but the meetings will be held in various government buildings. The registration office will be in the auditorium of the District of Columbia Building.

An unusual program of technical sessions, round table discussions and inspection trips has been prepared by a committee of which Herbert D. Brown, chief of the U. S. Bureau of Efficiency, is chairman. The members and their guests will be presented to President Harding and will hear Secretary of Commerce Hoover in an address on office efficiency.

Manufacturers and Supply Men in Convention at Birmingham

The joint convention of the American Supply and Machinery Manufacturers Association with the Southern Supply and Machinery Dealers Association was held in Birmingham, Ala., April 24 to 26. The convention was well attended by several hundred mill supply men from the Southern and Western territories. A general feeling of business optimism pervaded the meetings and predicted a healty growth in the machinery business during the coming months.

One of the most important addresses of the convention was delivered by Col. Peter O. Knight, well-known Southern jurist and counsel for the Southern Hardware Jobbers Association. Col. Knight's subject was "Optimism." He delivered a scathing denunciation of our present legislative organization, and severely criticized the sixteenth, seventeenth, eighteenth and nineteenth amendments to the constitution of the United States, stating that they were against the principles laid down in the original constitution. He also attacked the method of electing representatives and senators to Congress.

C. H. Houston, Assistant Secretary of Commerce, made a brief address in which he called atention to the closer relations existing between his department and the trade associations of the country. He declared that the department wished to have these relations of such a nature as to be of greater service to business. Other speakers were: W. H. Kettig, chairman of the Birmingham Branch of the Federal Reserve Bank; C. W. Beaver of the Yale & Towne Manufacturing Co., and N. A. Gladding, president of the American Association.

Bosch Service Plan

The American Bosch Magneto Corporation has inaugurated a special service plan which is intended to take care of all Bosch electrical equipment through the 500 or more service stations throughout the country. This service includes the registration directly with the company and its official representatives, as soon as the equipment is put in service. When a car, truck, tractor, engine or other product equipped with Bosch electrical apparatus is sold, the dealer fills out a postcard supplied him for that purpose, and mails it to the American Bosch Magneto Corporation, or one of its branches. Upon the receipt of this card, which contains all the information relative to the sale, the Bosch Corporation registers it and furnishes the purchaser with an identification card which entitles him to free service at any Bosch service station during the guarantee period.

The idea of this plan is to keep all genuine Bosch parts in working condition, and to eliminate the trouble often experienced by users of Bosch equipment in securing service repairs and renewal of parts. This service also keeps the company in close touch with the purchaser during the time of its responsibility to him. It also helps to protect the reputation of the company and its products.

Business Items

The Reeves Pulley Co., Columbus, Ind., announces that the manufacture and sale of Reeves centerless roll grinders is now being carried on at the home plant in Columbus. Agency distribution has been discontinued.

The International Blower Co. has been incorporated at Hartford, Conn., with a capital of $50,000. C. H. Keeny is president. The company has purchased the entire business of the Connecticut Blower Co., of Hartford, including the machinery, tools, stock, equipment, etc., and has moved into its own factory at 345 Trumbull St., Hartford.

At the annual meeting of the directors of the Abrasive Company of America, Ltd., Hamilton, Ontario, the following officers were elected: Louis T. Byers, president; J. H. Byers, vice-president and general manager; L. J. Borris, vice president; S. P. Byers, secretary and treasurer; Frederick S. Dickson, chairman of the board.

The Power Plant Equipment Co., of Kansas City, Mo., has been appointed representative for the Combustion Engineering Corporation, of New York.

The Jones & Fiefield Co. has been organized at Joplin, Mo., and has opened a machine shop at 2330 Baxter Ave.

John L. Taylor, of Philadelphia, dealer in power and contracting equipment, iron and wood-working machinery, announces the removal of his business from the Bulletin Bldg. to 211 North Third St. He would like to hear from manufacturers with agencies open in his lines.

The Reliable Machine Works Co., 1188 Main St., Bridgeport, Conn., recently changed the name of the concern to the Wheeler Insulated Wire Co., and will manufacture insulated wire and products.

The New England Tube and Stamping Co., West Haven, Conn., recently incorporated to take over the business of the Coe-Stapley Manufacturing Corporation, was organized at a recent meeting of the stockholders. P. J. Holdsworth, Gramercy Park, New York, has been elected president; J. M. Harding, New Haven, vice-president; Robert R. Adams, of Bridgeport, secretary and treasurer. Messrs. Holdsworth, Harding and Adams, also constitute the board of directors. The company will manufacture tubing, sheet-metal products and automobile accessories.

The Hat City Foundry Co., of Danbury, Conn., has recently filed incorporation papers, to engage in the foundry business. The capital stock is $15,000, and the incorporators are F. A. Shepard, J. P. Fahey and E. S. Ross, all of Danbury, Conn.

The Bridgeport Brass Foundry, Inc., of Bridgeport, Conn., has filed a preliminary certificate of dissolution with the Secretary of the State of Connecticut, and any claims against the company should be sent to Ralph Johnstone, 530 Newfield Ave., Bridgeport.

The Merwin Screw Co., Inc., Bridgeport, Conn., has recently filed papers of incorporation under the laws of Connecticut, to engage in the manufacture of screws, etc. The capital stock is $10,000, and the incorporators are: Fred H. Merwin, E. W. Merwin and Robert C. Mallette, 884 Main St., Bridgeport, Conn.

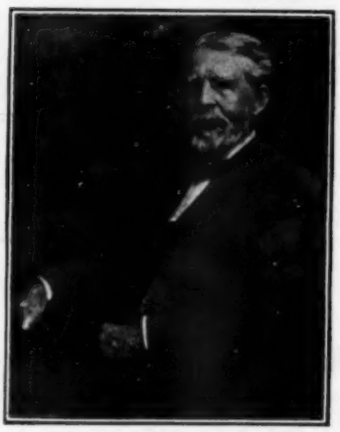
The International Tool and Gauge Co., 119 Broad St., Bridgeport, Conn., has recently opened a modern tool, die and gauge shop at the above address.

The W. F. Concannon Shear Co., Inc., of Milford, Conn., manufacturer of steel shears and scissors, recently increased the capital stock of the concern from $20,000 to $50,000.

The Lackawanna Tubes Ltd., recently organized, has taken over the properties and holdings of the Welland Machine and Foundries Ltd. The newly formed company has received authorization for a capitalization of $550,000 and will soon let contract for the construction of a new factory building. L. R. Weeks, of New York, is president and general manager of the company.

L. S. Starrett, Prominent Tool Builder, Dead

Leroy S. Starrett, president of the L. S. Starrett Co., tool manufacturers, Athol, Mass., died at his winter home in St. Petersburg, Fla., on April 23. He was born in China, Me., in 1836, and started his first machine shop in Newburyport, Mass., in 1866, after taking out patents on a washing machine, a butter worker and a meat chopper. Two years later he went to Athol and established the Athol Machine Co. He patented other devices, including a shoe hook fastener and a new type of vise. Suffering reverses, he lost control of the company, but soon afterward started a new concern, and began to produce the line of tools that has met with marked success.



LEROY S. STARRETT

Gradually he built up a large business and in addition to his control of the L. S. Starrett Co., he regained control of the Athol Machine Co., and also held the dominant interest in the Athol Manufacturing Co. and the Metropolitan Air Goods Co. He founded the Union Twist Drill Co. which has grown to be one of Athol's largest industries. He was active in business up to the beginning of the present year.

Personals

R. L. FOSTER, manager of the New York sales department of the American Steel and Wire Co., has been appointed assistant general sales agent.

HARRISON P. REED, for many years electrical engineer and more recently head of the elevator department of the Cutler-Hammer Manufacturing Co., of Milwaukee, has been appointed general manager of the A. Kieckhefer Elevator Co., Milwaukee. He will assume his new duties on May 1.

GEORGE POWERS has resigned after 48 years of continuous service with the Ludlow Valve Manufacturing Co., of Troy, N. Y. He will sail soon for a visit to England. For the past thirty years Mr. Powers has been foreman of the brass foundry.

H. R. PECKINS, who for the past several years has represented the Utica Drop Forge and Tool Co., Utica, N. Y., is now associated with the Peck, Stow & Wilcox Company with headquarters in Utica.

W. A. BACHMAN, formerly vice-president of the Hemp Hills Foundries, Pittsburgh, Pa., has been appointed superintendent of foundries of the New York Central Railroad Co., with headquarters in Frankfort, N. Y.

BENJAMIN B. GOTTESBERGER, of New York, has been appointed professor of mining at Yale University, New Haven, Conn. Mr. Gottesberger has had considerable mining engineering experience.

FRANCIS H. SHERWOOD has recently joined the sales division of the Yale & Towne Manufacturing Co., Stamford, Conn. Mr. Sherwood has had 12 years experience in the factory of the company.

FRANK L. EIDMANN, mechanical engineer of the Barrett-Cravens Co., Chicago, will sail this month for a six-months' business trip through Europe.

J. K. WILLIAMS, founder and former president of the Williams Foundry Co., Akron, Ohio, will re-enter the foundry business as vice-president of the Franz Foundry and Machine Co., of Barberton, Ohio.

W. T. DOYLE, formerly associated with the S. Freeman Co., boiler manufacturers, of Racine, Wis., is now associated with the Richter Machinery Co., of Milwaukee. He will have charge of the boiler department.

A. S. DUNCAN, storekeeper at the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Co., has been appointed general storekeeper of finished stocks.

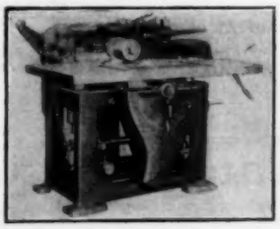
W. H. MILLER has been appointed supervisor of tools and gages in the inspection department of the Westinghouse Electric and Manufacturing Co. works at East Pittsburgh, Pa.

E. R. JACKSON, who during the war was assistant chief engineer at the Rock Island Arsenal and more recently sales manager for the Helsbels Iowa Co., Davenport, Iowa, has been elected secretary and superintendent of the Square Turn Tractor Co., of Norfolk, Neb.

Condensed-Clipping Index of Equipment

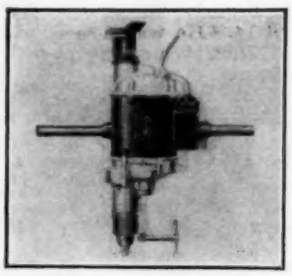
Patented Aug. 20, 1918

Saw, Rip, Wood, Self-Feed, No. 65
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," January 12, 1922



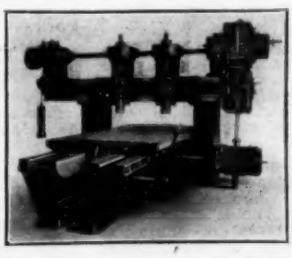
The machine rips all kinds of lumber and handles either rough or finished stock. The in-feed spur roller, either corrugated or smooth, carries the stock across the table top and through the saw. The machine holds saws up to 18 in. in diameter, cuts lumber up to 5 in. thick, and rips up to 24 in. wide. Six saws may be used at one time. There are three rates of feed, 80, 110 and 140 ft. per minute. Equipment: one 16-in. saw, saw guard, feed spur and guard, splitter, one plain and one corrugated sectional out-feed roll, filling collars and sawdust chute. Table 33½ x 56 inches.

Drill, Electric, Portable, Universal, "Super"
Hisey-Wolf Machine Co., Cincinnati, Ohio.
"American Machinist," January 12, 1922



The drill uses either direct- or single-phase alternating current of any frequency from 25 to 60 cycles, and is equipped with ball bearings throughout. It is made in three sizes, with capacities in steel of ½, ¾ and 1 in. It is supplied for 110 or 220 volts, but can be furnished for special voltages up to 250. A Jacobs drill chuck is supplied for holding straight-shank drills. A Morse No. 1 taper socket can be furnished. The drill may be fitted with a screw feed, breast plate, grinding wheel, flexible shaft and a stand. Weight, 18, 22 and 24 lb., respectively.

Milling Machine, Planer-Type, Vertical, Double-spindle
Beaman & Smith Co., Providence, R. I.
"American Machinist," January 19, 1922

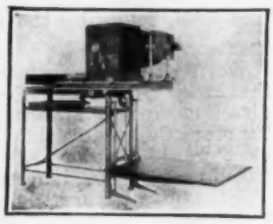


The machine has a fixed cross-rail with two independent heads, each with power feed for separate or simultaneous use. The table has a traverse equal to its length. Power feed from 1 to 8 in. per minute is available for all movements. There is a quick traverse for each movement at constant speed, independent of the feed. Three levers upon the operating side of the machine control all movements. A hand-wheel on each head provides a vertical spindle movement of 12 in. Inserted-tooth cutters 10 in. in diameter are used. Width between housings, 64 in. Table, 60 **x 96 in. Weight, 50,000 lb.** Floor space, 11 x 16 ft.

Cutting Machine, Oxy-Acetylene, Automatic, "Gewe"
General Welding & Equipment Co., 74 Brookline Ave., Boston, Mass.
"American Machinist," January 19, 1922

The machine cuts metal parts such as dies, cams, crankshafts and drop-forge tools directly from the steel plate. It has two carriages. The upper carriage supports on one side an oxygen-acetylene cutting torch, and on the opposite side the driving and the tracing system. A fiber template with the work outline grooved in it must be used. The speed can be regulated electrically by a rheostat or mechanically by changing the position of the friction wheel on the disk. The torch may be operated on either oxygen and hydrogen, or on oxygen and acetylene. The machine is made in two sizes having capacities of 12 x 12 in. and 24 x 24 in., respectively. Cutting speed, 18 in. per min. for ½-in. stock, to 7 in. per min. for 4-in. stock.

Photostat, All-Steel
Photostat Corporation, 299 State St., Rochester, N. Y.
"American Machinist," January 12, 1922

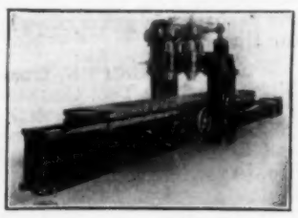


The chief feature of the machine is its all-metal construction. It is made in the same sizes as the former model. Roller bearings are used for the magazine and bellows. The mechanism for elevating and lowering the engineering copyboard or bookholder has been strengthened. A separate developing tank is carried on the side of the machine. All parts of the photostat are protected from splashing chemicals and erosion from the escaping fumes of the chemicals. The knife mechanism for cutting off prints has been strengthened. The adjustable curtain makes the magazine light proof and protects the sensitized paper when the magazine is open.

Indicator, Dial, "Junior"
Atlas Indicator Works, 160 North Wells St., Chicago, Ill.
"American Machinist," January 12, 1922

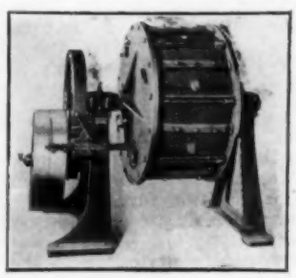
A swiveling clamp mounted on the back of the housing holds the dial in the most convenient position for reading. The indicator dial is graduated to 0.001 in., and has a range of 0.055 in. The position of the contact point can be changed for different sorts of inspecting operations. After adjusting the contact point on the work, the dial may be revolved so as to bring the zero mark in line with the indicator hand.

Milling Machine, Planer-Type, Double-spindle, Intermittent Feed
Beaman & Smith Co., Providence, R. I.
"American Machinist," January 19, 1922



The machine is used for spot milling castings with surfaces in one plane but not continuous. The table power feed covers the full length of travel. The crossrail is fixed and mounted with two vertically adjustable spindles without power movement. The special feature of the machine is the "jump," or intermittent feed controlled by a series of adjustable cam dogs. A gear box provides changes of feed. A pair of three-step cones and belt permits of varying the rate of quick traverse between cuts. The machine can be furnished with dimensions to suit any piece that is to be machined in quantities. Table 24 in. x 14 ft.

Burnishing Machine, Ball
Abbott Ball Co., Hartford, Conn.
"American Machinist," January 19, 1922



The chief feature of the machine is that the work is held stationary on the inside of the barrel body, and as the barrel rotates the parts are carried through the cleaning mixture without striking against one another. The barrel has eight sides, each having a hand hole with a hinged cover. The packing around the edges of the hinged covers makes the barrel watertight. The work fixtures are fastened to the inside of the cover plates. Several sets of cover plates and work fixtures are usually provided for each machine.

Clip, paste on 3 x 5-in. cards and file as desired

M. H. ROBERTS has been appointed vice-president in charge of engineering of the Franklin Railway Supply Co., Inc., New York City. He was previously chief engineer.

J. G. WORKER, vice-president and general manager of the Phoenix Manufacturing Co., Eau Claire, Wis., has become president and directing head of that firm, following the resignation of C. L. Tolles.

W. A. THOMAS, former president of the Brier Hill Steel Co. and now a director of the Mansfield Sheet and Tinplate Co., Mansfield, Ohio, has been elected a director of the General Fireproofing Co., succeeding R. M. Thell who continues as secretary and treasurer.

HARRY R. JONES, former president of the United Alloy Steel Corporation and now a member of that corporation's executive board, has been named a director in the Dominion Alloy Steel Corporation, a new $15,000,000 concern to be located at Sarnia, Ontario, Canada.

C. C. LYND, who has been in charge of the New Orleans office of the American Rolling Mill Co., Middletown, Ohio, has been placed in charge of the office which has been opened in Houston, Tex.

WALTER F. ROGERS, formerly with the Norton Company, has joined the sales staff of the Reeves Pulley Co., Columbus, Ind.

JOHN A. JOHNSON, of Chicago, has been appointed works manager for the K & F Manufacturing Co., engineers and tool builders, of Kenosha, Wis.

WALDO M. PITKIN, general manager of Albert Baldwin & Co., Ltd., of New Orleans, La., dealer in hardware and machinery, has been re-elected president of the Southern Hardware Jobbers Association, which has just closed its annual convention. John Donner, of Richmond, Va., secretary-treasurer for the past fifteen years, was again chosen for that office.

WILLIAM J. GRIPPIN, treasurer of the Bilton Machine Tool Co., manufacturers of machinery and tools, Bridgeport, Conn., has been chosen treasurer and a director of the Artistic Bronze Co., bronze manufacturers of Bridgeport, Conn.

HARRY HALSALL, of Atkinson, Haserick & Co., distributors of cotton manufacturing machinery, of Boston, and Bradford, Eng., sailed from this country recently for England, where he plans to spend the next two months on business, both in England and on the continent.

MARK A. MILLER, of the New York office of the Yale & Towne Manufacturing Co., Stamford, Conn., has joined the sales force of that company, and will shortly go on the road in the Western territory. Mr. Miller has been with the company since 1919.

PETER H. BULLOCK retired on May 1 as chief engineer of the Massachusetts Reformatory, at Concord Junction, Mass., after serving continuously in that position for 42 years. Mr. Bullock served his apprenticeship in a railroad shop fifty-six years ago. He was a frequent contributor to the columns of AMERICAN MACHINIST, and in 1888 wrote a series of articles on the "Modern Steam Plant and Its Management."

M. D. EBBETS, formerly of the New York branch of the Sloan Valve Co. of Chicago, has been appointed northern New England representative of the company. Mr. Ebbet will be located at 45 Tremont Bldg., Boston, and his territory embraces Maine, New Hampshire, Vermont and eastern Massachusetts.

T. M. RUSSELL, president of the Russell Manufacturing Co., Middletown, Conn., recently returned to this country after an extended trip into Egypt.

Obituary

ROBERT H. ILLINGWORTH, vice-president of the Crucible Steel Co., died on April 23 at his home in Newark, N. J. Mr. Illingworth had been in the steel business for the past forty-two years.

WALTER E. VOIGHT, president of the Mobile Steel Co., Mobile, Ala., died in that city on April 4.

GEORGE R. WALES, of Beverly, Mass., died in Boston on April 14. He was a member of the firm of John Wales & Co., iron and steel producers.

Trade Catalogs

Simplex Tools. Simplex Tool Co., Woonsocket, R. I. A small booklet describing a line of production and inspection tools. Each type is illustrated and specifications and price lists are included.

Toledo Steels. The Toledo Steel Works, Sheffield, England; manufactured by John Hy. Andrew & Co., Ltd., United States branch, Newman-Andrew Co., New York City, N. Y. A catalog describing a line of crucible steels, made to Sheffield practice. Tables of heat-treatment and annealing operations are given for all kinds. Price lists are included.

"Stoever" Pipe Machines. Treadwell Engineering Co., Easton, Pa. Sixteen-page catalog devoted to a description of "Stoever" pipe machines, made by the Treadwell Company. Several sizes and types are shown, details given and parts illustrated.

The Mummert-Dixon Co., Hanover, Pa., patternmakers and oilstone grinders, are distributing a small booklet entitled "Something Interesting About Stars." It contains some very interesting facts on astronomy, a brief study of cosmogony, and descriptive paragraphs on molecules, atoms and electrons.

Book Reviews

Thermal Expansion of Nickel, Monel Metal, Stellite, Stainless Steel and Aluminum. Scientific Paper No. 426, of the Bureau of Standards, Department of Commerce, by Wilmer H. Souder and Peter Hidnert. Complete copy of the paper may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 10 cents.

The increasing use of nickel and nickel alloy wire in spark plugs; of monel metal for high-pressure steam valves, stems, seats; of stellite for surgical and household uses; of stainless steel for engine valves, pump rods, marine fittings; and of aluminum or its alloys where lightness is necessary—has created a demand for information regarding the thermal expansion of these materials. Data on the thermal expansion of twenty-nine samples of these metals are given in this book together with results obtained by previous observers on the expansion of nickel and aluminum. All of these samples except stainless steel (heated to 900 deg. C.) were examined from room temperature to about 600 deg. C.

The results are presented in the form of tables and curves. Commercial nickel indicated only a slight irregularity at about 350 deg. C., and annealing of hot-rolled samples of nickel caused a slight increase in the coefficients. The expansion curves of monel metal were found to be fairly regular, but for temperature range from 25 to 600 deg. C. the average coefficients of the cast samples were greater than those of hot-rolled alloys. Stellite expansion curves showed irregularities in the region between 300 and 500 deg. C., the sample containing tungsten having the smallest coefficient, while there were indications that hammering may lower the value of the coefficient of expansion. Both annealed and hardened stainless steel curves indicated critical regions from 825 to 855 deg. C., the hardened stainless steel curve being irregular between 200 and 400 deg. C., where strains produced in hardening were released. The coefficients of hardened or annealed stainless steel were less than the coefficients of ordinary iron or steel. Thermal expansion of aluminum was found to be approximately twice as large as that of the other materials.

For the range from room temperature to 100 deg. C., the coefficients of expansion varied from 9.6×10^{-6} for a sample of hardened stainless steel to 23.8×10^{-6} for a sample of exceptionally pure aluminum.

Co-operative Competition. A series of twenty-five articles on trade associations published in the New York *Evening Post* and reprinted in pamphlet form. Copies may be secured from the *Evening Post*, 20 Vesey St., New York. Price 25 cents.

Coming at a time like the present when the activities of trade associations are the center of interest in more places than one, this series of articles on various phases of co-operative competition is decidedly timely. The foreword is by Secretary Hoover and the articles are by leaders in various lines of business, trade association officials, Department of Commerce and Federal Trade Commission experts and others. They are worth reading.

Forthcoming Meetings

National Association of Manufacturers: Annual meeting, Waldorf-Astoria Hotel, New York City, May 8, 9 and 10. Secretary, George Boudinot, 50 Church St., New York.

American Society of Mechanical Engineers: Spring meeting, Atlanta, Ga., May 8 to 12. Secretary Calvin W. Rice, 29 West 39th St., New York City.

National Supply and Machinery Dealers Association: Annual Convention, Atlantic City, May 8 to 10. (In conjunction with American Supply and Machinery Manufacturers Association.) Secretary, Thomas A. Fernley, 505 Arch St., Philadelphia, Pa. Headquarters will be in the Marlborough-Blenheim Hotel.

Foreign Trade Council: Annual Convention, Philadelphia, Pa., May 10 to 12. Secretary, O. K. Davis, 1 Hanover Square, New York City.

United States Chamber of Commerce: Annual meeting, Washington, D. C., May 16 to 18. Secretary, D. A. Skinner, Riggs Bldg., Washington, D. C.

National Association of Office Managers: Annual meeting, Washington, D. C., May 18 to 20. Secretary, F. L. Rowland.

American Society for Steel Treating: Pittsburgh Section meeting, Bureau of Mines Auditorium, Pittsburgh, Pa., May 25 and 26.

American Foundrymen's Association: Annual meeting, Rochester, N. Y., week of June 5. Secretary, C. E. Hoyt, 140 South Dearborn St., Chicago, Ill.

American Railway Association: Section III, Mechanical: Annual meeting, Atlantic City, June 14 to 21. (Formerly the Master Car Builders and the Association of Master Mechanics.)

Society of Automotive Engineers: Summer meeting, White Sulphur Springs, W. Va., June 20 to 24. C. F. Scott, 29 West 39th St., New York City, is chairman of the convention committee.

American Society for Testing Materials: Twenty-fifth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 26 to July 1. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Fly-Cutter Holder, Milling Machine
George W. Dover Co., Inc., Providence, R. I.
"American Machinist," January 19, 1922

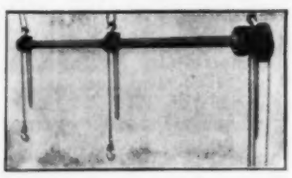
The holder is used in making small dies and manifold form cutters for screw machines. It fits over the spindle nose of a milling machine and clamps to the face of the column. The inner end of the arbor is tapered to fit the spindle hole, and bears on a bronze sleeve housed in the frame of the device. The arbor may be held stationary with the cutter in any desired position. The casting carrying the bearing sleeve can be swiveled to an angle of 20 deg. either way, and is graduated.

Tractor, Industrial, Electric, Type-K
Mercury Manufacturing Co., 4118 South Halsted St., Chicago, Ill.
"American Machinist," January 19, 1922

The machine is used for light work in close quarters. A General Electric motor operating on 24 volts and 50 amperes at 1,500 r.p.m. is used, the drive being through worm gearing to the rear axle. The drum-type controller gives three speeds forward and one reverse. The brake is of the contracting-drum type and is operated by a foot pedal. The machine has a normal draw-bar pull of 400 lb., with a maximum of 650 lb. The speed when running light is about 6 miles per hour. Width, 29 in. Height, 48 in. Length, 56 in.

Hoist, Triple-Hook
Wright Manufacturing Co., Lisbon, Ohio.
"American Machinist," January 19, 1922

The three hooks are operated simultaneously by one hand chain and are intended for lifting and conveying flexible materials such as bundles of long wires, metal bars, tubes and sheet metal. The hooks are connected by lengths of pipe, and are ordinarily placed 5 ft. apart, although this distance may be varied. The hoist has a capacity of 1 ton, but can be furnished in larger sizes. It is ordinarily suspended from three ½-ton plain trolleys running on an overhead I-beam.



Scleroscope, Portable, "Auto Punch"
Case Hardening Service Co., 2283 Scranton Road, Cleveland, Ohio.
"American Machinist," January 19, 1922

The device is made in two sizes, the 12-in. size for work on steel, iron and hard metals, and the 6-in. size for sheet brass and thin metals. By pressure on the barrel the spring hammer is released and strikes the ball. The resulting depression in the work is then measured, as in the Brinell test. The tested piece must rest on a solid support, but usually can be tested in position. The hardness of steel plate, stampings, forgings and castings, as well as that of case-hardened and heat-treated work, can be determined. A pressure of 850 kg. on a ½-in. ball gives a depression of the same size as that of the 12-in. punch when testing mild steel.

Press, Straightening, Hand, "Production," No. 2P
P. A. Geier Co., Cleveland, Ohio.
"American Machinist," January 19, 1922

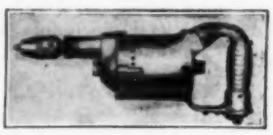
The press is adapted to production work on crankshafts. A lever and graduated handwheel apply the driving force. The thrust block of the screw has a range of from 2 to 8 in. distance from the table. The work is straightened without removing it from the centers. A screw is used to adjust the position of the work. A dial indicator having a stroke of ¼ in. shows the eccentricity of the work. Rollers mounted above the center points hold the longer work, and for this an extra pair of thrust blocks is furnished. Maximum distance between center points, 40 in. Bed, 26 in. long. Floor space, 22½ x 82 in. Height, 55½ in. Weight, 500 pounds.

Attachment, Milling, Lathe
George W. Dover Co., Inc., Providence, R. I.
"American Machinist," January 19, 1922

The device can be bolted to the toolblock of an 18-in. engine lathe to do small milling work such as tap and reamer fluting and cutting teeth in small cutters. It is used chiefly in shops where the range of milling work is limited and where no small machine for this work is available. The dividing head is mounted on a graduated swiveling plate that can be set to any angle up to 20 deg. on either side. A set of removable index plates is keyed to the lower end of the spindle. A vise may be mounted in place of the dividing head. A V-block can be attached in any angular position to support slender work. The elevating screw gives vertical adjustments to 0.001 in. The slide may be clamped in any position.

Drill, Electric, Portable, "Buzz"
United States Electrical Tool Co., Cincinnati, Ohio.
"American Machinist," January 19, 1922

The machine is used both for metal drilling and wood boring, and is driven by a universal type motor for both direct or alternating current. The controlling switch is located in the handle. The gears are made of hardened chrome-nickel steel, and run in grease. The spindle is fitted with ball thrust bearings. Spindle speed, 1,100 r.p.m. Weight, 6 pounds.



Hardening Tool, Magnetic, "Temperite"
Pittsburgh Stencil and Tool Co., 40 Water St., Pittsburgh, Pa.
"American Machinist," January 19, 1922

The device is used in determining the proper hardening heat for carbon steel, as ordinary carbon steel attracts a magnet as long as it is under the correct hardening heat, but as soon as this heat is reached the steel has no magnetic attraction. The tool consists of a balanced and insulated magnetic tilting bar mounted on the end of a rod. The bar, made of special steel that enables it to retain its magnetism better than an ordinary magnet, is not affected to any great extent by the heat. The bar will tip when brought near the work, until the correct hardening temperature has been reached, at which point it is no longer affected.

Clip, paste on 3 x 5-in. cards and file as desired

The Weekly Price Guide

THIS WEEK'S MARKET

Advances—Minimum of $1.60 quoted on steel shapes, plates and bars at Pittsburgh mills. Several makers quoting as high as $1.70 per 100 lb. on small tonnages. All semi-finished steel up $2 per ton. Pig iron prices firmer in Pittsburgh and Birmingham. Blue annealed sheets, base size, up 10c. in New York and 5c. per lb. in Cleveland warehouses. Galvanized sheets also slightly advanced in Cleveland. Structural shapes, bars, tank plates and floor plates up 10c. per lb. in Cleveland and New York warehouses.

Lead quoted in New York at 5¾c. as against 5⅝c. per lb.; raw linseed oil at 91c. as compared with 89c. per gal. (5 bbl. lots).

Declines—Tin quoted at 31⅞c. as against 32¼c. per lb. in New York. Declines in copper rods, zinc sheets and brass sheets, rods and wire in New York; slight drop in brass rods and copper sheets, wire and rods in Cleveland.

Improvement in electrolytic copper with upward tendency in price; zinc firm.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$20.50
Northern Basic	20.78
Southern Ohio No. 2	20.50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	26.16
BIRMINGHAM	
No. 2 Foundry	16.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	22.34
Virginia No. 2	28.24
Basic	20.25
Grey Forge	21.00
CHICAGO	
No. 2 Foundry local	20.00
No. 2 Foundry, Southern, sil 2.25@2.75	16.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.96
Basic	21.46
Bessemer	21.96

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Pittsburgh	9.0	6.0	3.0
Philadelphia	8.5	5.0	3.0
Atlanta	5.5	4.5	4.0
Detroit	7.0	4.5	3.0
Birmingham	12.0	6.5	3.0
Denver	8.0	6.0	5.0
New Orleans	6.0	4.5	3.5
Minneapolis	9.0	6.0	4.5
New York	9@10	6.0	3.0
Cincinnati	6.0	5.0	4.5
Cleveland	6.75	4.5	2.6

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 40	3.38	3.15	3.38
No. 12	2.45	3.43	3.20	3.43
No. 14	2.50	3.48	3.25	3.48
No. 16	2.70	3.58	3.35	3.58
Black				
Nos. 17 and 21.	3.00	4.05	3.55	4.10
Nos. 22 and 24.	3.05	4.10	3.60	4.15
Nos. 25 and 26.	3.10	4.15	3.65	4.20
No. 28	3.15	4.25	3.90	4.30
Galvanized steel sheets:				
Nos. 10 and 11.	3.15	4.25	3.75	4.30
Nos. 12 and 14.	3.25	4.35	3.85	4.40
Nos. 17 and 21.	3.55	4.65	4.15	4.70
Nos. 22 and 24.	3.70	4.80	4.45	4.85
No. 26	3.85	4.95	4.60	5.00
No. 28	4.15	5.25	4.90	5.30

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel BUTT WELD Inches	Black	Galv.	Iron BUTT WELD Inches	Black	Galv.
1 to 3	71	58½	¾ to 1¼	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1¼	69	57½	¾ to 1¼	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	7.00	8.00	6.03
Hoop steel	3.38	2.81	3.13
Cold rolled strip steel	6.25	8.25	6.35
Floor plates	4.70	4.66	4.98
Cold finished shafting or screw	3.35	3.00	3.30
Cold finished flats, squares	3.85	3.50	3.80
Structural shapes (base)	2.58	2.41	2.38
Soft steel bars (base)	2.48	2.31	2.28
Soft steel bar shapes (base)	2.48	2.31	2.28
Soft steel bands (base)	2.98	....	2.88
Tank plates (base)	2.58	2.41	2.38
Bar iron (2.00@2.10 at mill)	2.48	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
⅝	8.00		12@13
½	6.50		11@12
7/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York	13.62½		
Tin, 5-ton lots, New York	31.75		
Lead (up to carlots), St. Louis, 5.40; New York	5.75		
Zinc (up to carlots), St. Louis, 5.27½; New York	5.62½		
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	6.75	6.25
Copper sheets, base	19.50@20.50	19.50	23.00
Copper wire (carlots)	14@14.25	16.00	16.25
Copper rods (ton lots)	17.75	21.00	19.50
Copper tubing (100-lb. lots)	20.75	22.50	23.00
Brass sheets (100-lb. lots)	15.75	17.00	18.75
Brass tubing (100-lb. lots)	18.00	18.50	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	13.75	15.00	15.75
Brass wire (carlots)	16.25	17.75	.....
Zinc sheets (casks)	8.50	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....
Solder (½ and ½), (caselots)	23.00	22.00	19.00
Babbitt metal (fair grade)	30.80	39.50	36.00
Babbitt metal (commercial)	15.50	13.50	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.50	10.25
Copper, heavy, and wire	9.50	9.50	9.25
Copper, light, and bottoms	8.50	8.50	8.25
Lead, heavy	3.75	3.75	3.65
Lead, tea	2.75	2.75	3.00
Brass, heavy	5.75	5.50	8.00
Brass, light	4.25	4.00	4.75
No. 1 yellow brass turnings	5.00	5.50	5.00
Zinc	2.75	2.25	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	11.00	14.50
IC, 112 sheets	12.80	11.40	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	5.60	7 25
IC, 14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, perl b	.055@.09	.09	.09
Wiping cloths per M., 13½x13½	.....	50.00	55.00
Wiping cloths per M., 13½x20½	.....	55.00	65.00
Sal soda, 100 lb. lots	2.80	2.50	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.91	.95	.90
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$3.25@$3.50	
Coke, prompt foundry, Connellsville	per net ton	$4.25@$4.75	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	60-5%	60-10%	60%
1½ and 1¼x3 in. up to 12 in	50%	60-10-10%	60-10%
With cold punched sq. nuts	50%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	55%	.....	$4.00 off
Button head bolts, with hex. nuts	35%	$3.90 net	.....
Hex. head and hex. nut bolts	40%	.....	65-5%
Lag screws, coach screws	65%	.....	60-5%
Square and hex. head cap screws	75—10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	50-10%	60-10%	50-5%
Bolt ends, with hot pressed nuts	60%	.....	55%
Tap bolts, hex. heads	25%	.....	.....
Semi-finished nuts ⅝ and larger	75%	75-10%	80%
Case-hardened nuts	65%	.....	.....
Washers, cast iron, ⅛ in., per 100 lb. (net)	$4.50	$3.50	$3.50
Washers, cast iron, ¼ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	4.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	3.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	3.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	3.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	3.00	3.50	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller	60-5%	60-10-10%	60-10%
Rivets, tinned	60-5%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$3.50	$3.25	$3.00
Cone heads, ditto (net)	3.60	3.35	3.10
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
¾ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	60-5%	50%	50-10%
Copper burs	40%	50%	.....
Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine oil, lubricating, (50 gal. bbl.) per gal.	0.45	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50%	50-5%	60-10%
Medium grade	40-5%	40-10-2½%	50%
Heavy grade	35%	40%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.49
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Feiger & Co., 1529 West 14th St.—tinner brake, 8 or 10 ft. long.

Ill., Chicago—The Hess Warming & Ventilating Co., 1219 South Western Ave. —power square shears, (used).

Ill., Oak Park—The Atlas Educational Film Co., 1113 South Blvd.—one engine lathe, 7 x 14 in. swing, short bed, (used).

Kan., Madison—W. J. Turner—centering equipment including 1¼ x 26 or 28 in. mandril and table, for machine shop.

Mass., Cambridge—The Boston Structural Steel Co., Inc., 241 Albany St.—one automatic screw machine, No. 2 Brown & Sharpe preferred, (used); one punch press No. 20 Bliss preferred; one rotary shear and one small hand screw machine.

Mo., Aurora—The Aurora Welding Co.—power lathe and drill press.

Mo., Joplin—J. Bailer Wks., East 5th St., (pump factory), J. Schaeffer, Purch. Agt.—power drill press, lathe, belting and shafting and pump making machinery.

Mo., Joplin—Craig & Bortbeck, Motor A, County Line and Main St., B. D. Craig, Purch. Agt.—power drill press and lathe for garage.

Mo., Joplin—The Greenwell Brass Fdry., East 7th St., F. Greenwell, Purch. Agt.—power lathe for brass work.

Mo., Joplin—M. Henson, 2625 Main St., blacksmith—lathe and drill press for power work.

Mo., Joplin—The Joplin Handle & Novelty Co., 2625 Main St., J. C. McDaniel, Purch. Agt.—large wood lathe and wood working machinery.

Mo., Joplin—The Joplin Mchy. Exchange, 211 East 4th St., W. Clark, Purch. Agt.—lathes for machine shop.

Mo., Joplin—The Kennedy Auto Shop, 26th and Main Sts., J. Higgenbothem, Purch. Agt.—lathe for power equipment.

Mo., Joplin—L. & O. Garage, 2010 Main St., E. C. Lawson, Purch. Agt.—power lathe and drill press.

Mo., Joplin—The Osage Garage, 110-112 Joplin St., F. Cecil, Purch. Agt.—crank shaft, grinder and cylinder grinder.

Mo., Joplin—W. H. Tharp, 2123 Main St., garage—power drill press and lathe.

Mo., Kansas City—The Packard Motor Co. of Missouri, 25th and McGee Sts., garage and machine shop, T. H. Smith, Purch. Agt.—full machine shop equipment for garage.

Neb., Lincoln—The Kimball Motor Car Co., 1608 O St., C. C. Kimball, Purch. Agt. —pneumatic or electric grinder, also lathe with 8 ft. bed.

Neb., Lincoln—The Nebraska Mchy. and Supply Co., 177 North 9th St., W. H. Bixby, Purch. Agt.—wood band saw, plane table; small light high speed drill press; combination punch and shear Beloit preferred; one ton or 1½ ton Yale or similar chain hoist; power hack saw similar to No. 2 Marvel; 75-100 lb. blacksmith vise; 150-175 lb. anvil, (used).

N. Mex., Albuquerque—The Wood Motor Co., M. H. Wood, Purch. Agt.—$2,500 worth of equipment for machine shop including drill presses, grinding machinery, lathes and small tools.

N. Y., Binghamton—F. H. Wilbur & Son, Wall St., F. H. Wilbur, Purch. Agt.—machine tool equipment for shop specializing in repair work, etc.

N. Y., Buffalo—Klink & Shallon, Inc., 620 Babcock St.—packing plant equipment for proposed addition.

N. Y., Buffalo—The Natl. Lamp. Wks. of the General Electric Co., 1495 Fillmore Ave. —machine shop equipment including lathes, drills, etc.

N. Y., Great Bend—The O. L. Sisson Co. —woodworking tools and equipment also sheet metal tools for the manufacture of slatted wood and metal garage creepes.

O., Cincinnati—The Clifton-Pratt Co., 1224 West 8th St., A. B. Clifton, Purch. Agt.—one 36 in. New Haven sand blast barrel, (used).

O., Cincinnati—The Eastern Mchy. Co., 408 East Pearl St., A. Smith, Purch. Agt.—three or four spindle drill press, (sensitive).

O., Cleveland—The County Commissioners, C. J. Heiber, Court House—one LeBlonde quick change lathe, 18 ft. x 10 ft. for road repair department.

Pa., Brookville—The Bd. Educ.—equipment for vocational and engineering departments of the Brookville High School.

Pa., Phila.—F. J. Stokes Machine Co., 17th and Cambria Sts., F. J. Stokes, Purch. Agt.—boring machines, lathes, planer, cranes, etc.

Pa., Pittsburgh—The Edgewater Steel Co., P. O. Box 249, W. A. McKean, Purch. Agt.—one wheel boring mill, motor driven and must have automatic chuck, (used); one Ridgeway type hub facing machine for car wheels, motor driven, (used).

Va., Ashland—Fuqua Stone & Co., auto repairs—lathe, press, grinder and bench tools.

Va., Petersburg—The Petersburg Farm Machine Corp., 1009 South Sycamore St., H. L. Smith, Purch. Agt.—complete line of woodworking, machine shop and foundry machinery and equipment. Will consider slightly used.

Va., Richmond—The Auto Electric Repair Co., 932 West Broad St.—emery wheels, lathe, vise and reamer.

Va., Richmond—W. J. Harris, 820 West Broad St.—drill press.

Va., Richmond—F. D. Schluter, 922 West Broad St.—cylinder grinder and crank shaft grinder.

Va., Richmond—The Transportation Motor Co., 1410 West Broad St.—drill press, lathe and cylinder grinder for auto repair work.

Va., Richmond—H. C. Tutwiler, 1019 West Broad St.—flexible buffer, bead cutter, skiber and tread puller.

Va., Richmond—Winn, Mills & Wiler, 1001 West Broad St.—one 20 ton press, Weaver preferred.

Wis., Kaukauna—The School Bd., L. G. Schussmann, Supt.—complete equipment for manual training department of proposed high school.

Machinery Wanted

Ala., Birmingham—The Corona Coal Co., First Natl. Bank Bldg., A. Peacock, Purch. Agt.—one 36 in. circular saw mill with tilting tables to be used for mine timbers, etc.

Ala., Birmingham—Birmingham Building Material Co., 1317-21 Ave. E South—one cut off saw 24 in.; one planer; one 7½ hp., dc., 1,000 r.p.m. motor.

Ark., Little Rock—The Machinery Exchange, A. O. U. W. Bldg.—complete ice plant machinery for 10 ton ice plant, also direct connected engine and turbo-generator set of 150 kw. to 200 kw. capacity, 3 phase 60 cycle, 80 per cent power factor, exciter and switchboard complete, also turbo generator set of 500 kw. capacity, 3 phase, 60 cycle, 80 per cent power factor, exciter and switchboard complete.

Fla., Fort Meade—L. A. Morgan—canning machinery and equipment for canning factory.

Fla., West Palm Beach—The Atlantic Fish Co., C. Kennedy, Mgr.—fish canning machinery and equipment.

Ga., Barnesville—Collier Mills, Inc., J. A. Cason, Secy.—Wildman or Scott & Williams, 20 in., 21 in., 22 in., 23 in. underwear knitting machines, 12 cut, also one Payne winding machine.

Ga., Macon—W. E. Dunwoody, P. O. Box 255—one tractor for handling transfer cars.

Ga., Tignall—C. H. Hill—machinery for small broom manufacturing plant.

Ill., Dallas City—The Purity Moulding Sand Co.—one 24 ft. portable belt conveyor for handling sand from dump cart to freight cars.

Ind., Butler—The Higley Printing Co., M. Higley, Purch. Agt.—one 10 x 15 job printing press.

Kan., Galena—The Riceville Mining Co., J. Sparks, Purch. Agt.—belting, shafting and pulleys.

Kan., Parsons—P. Foley—equipment for daily newspaper plant.

Kan., Parsons—The Parsons Daily Sun, L. Combs, Purch. Agt.—newspaper equipment.

La., Monroe—The Southwest Pulp & Paper Co., G. Richter, Light & Power Bldg., Watertown, Purch. Agt.—paper making equipment for paper mill including paper machine, Jordan refining engines, Agitator gears and blade fittings, swng cut-off saw, wood rossers, wood chippers, wood screens, pulp screens, steam and acid digesters, conveying equipment, shafting, belting and miscellaneous transmission equipment, variable and constant speed drive clutches, boilers and engines and special lead and brass piping.

Mass., Clinton—The Roubaix Mills, Inc., 792 Main St.—one 66 in. shear, single or double, for shearing woolens and worsted.

Mich., Detroit—The Auto Collapsible Rim Co., Inc., c/o P. R. Rossello, Archt., 406 Congress Bldg.—machine equipment for the manufacture of metal rims and wheel parts.

Mich., Detroit—The Crating & Woodworking Co., 3652 Hart Ave.—woodworking machinery.

Mich., Detroit—The D. E. Morand Mchy. Co., 87 Quincy Ave.—one 300 or 400 lb. board drop hammer.

Mass., Fall River—The Fyans, Fraser & Blackway Co., 83 Anawan St.—automatic looms, (used).

Mo., Carthage—The Leggett & Platt Bed Spring Co., C. B. Platt, Mgr.—machinery for the manufacture of bed springs for proposed factory on Vine St.

Mo., Joplin—Pitkin, Boyd & Neal Packing Co., 7th St.—refrigeration equipment for remodeled plant.

Mo., Joplin—The Typographical Union, Printers Bulletin, 1621 South Main St., E. L. Bucher, Business Mgr. — newspaper equipment and linotype machine.

Mo., Joplin—The Ward Optical Co., 530½ Main St., G. Ward, Purch. Agt.—lens grinder, power.

Mo., St. Louis—The Mindlin Printing Co., 211 North 7th St.—printing press, 10 x 15 or 12 x 18.

Neb., Lincoln—The Independent Bindery Co., 133 South 12th St., W. K. Pease, Purch. Agt.—punching machine and perforating machine either motor or foot power.

Neb., Lincoln—G. V. Keller, 18th and N Sts.—machinery and equipment for repair shop including bench drill press and a lathe about 18 in. x 10 ft.

Neb., Lincoln—The University of Nebraska, L. F. Seaton, Purch. Agt.—one 3 roller cylinder press about 28 in. x 41 in. with motor, brachet, rollers and book chase; one heavy duty press with rollers, counter and motor; one stitcher; one power cutter; type, and cabinet.

N. J., Kearney—The Greenfield Mchy Agency, 99 Tappan St.—one 4 ft. and one 6 ft. power brake, both to bend 4 gage sheets to 90 degrees.

N. Y., Binghamton—The LaFlint Battery Corp., J. W. LaDuska, Purch. Agt.—machinery and equipment for charging and repairing storage cells, electric testing equipment.

N. Y., Brooklyn—D. C. Budd, 128 Martense St.—one steam engine slide valve, 50 hp., and one extractor, Tolhurst preferred.

N. Y., Brooklyn—The Estate of A. Starke, Columbia and Sigourney Sts.—one ton electric hoist for a.c. current.

N. Y., Buffalo—W. H. Beale & Son, 171 Hollywood St.—equipment for dairy.

N. Y., Buffalo—The Male Motor Truck Co., 184 Mohawk St.—one 42 in. arbor press.

N. Y., Buffalo—G. Stinson, 674 Swan St. —woodworking machinery.

N. Y., Corning—M. Gorman—equipment for bakeshop at Eustic, Fla.

N. Y., Fredonia—The E. & O. Mfg. Co.—machinery and equipment for factory recently purchased at Kane, Pa., for the manufacture of automobile signal devices, etc.

N. Y., Hamilton—The Madison County Basket Co., Inc.—machines and equipment for the manufacture of baskets, including steeping vats and washers.

N. Y., LeRoy—The LeRoy Lime & Crushed Stone Corp., J. L. Heimlich, Purch. Agt.—stone drilling, quarrying and crushing machinery.

N. Y., Morris—The Chronicle Office, B. F. Waite, Purch. Agt.—printing equipment and printing matrices for newspaper plant.

N. Y., New York—M. Billet, 40 East Houston St.—one No. 1 plain back geared milling machine.

N. Y., New York—The MacGovern Co., 114 Liberty St.—bending roll, 8 ft. long, 9 in. diameter and one bending roll 146 in. long, 20 in. diameter.

N. Y., New York—The Worthington Pump & Mchy. Corp., 115 Bway., C. W. Hodges, Genl. Purch. Agt.—electrically operated crane, 25 ton capacity for its Blake & Knowles Wks. at East Cambridge, Mass.

N. Y., Rochester—The Scott Bros. Constr. Co.—tools, equipment, etc. for blacksmith shop now under construction.

N. Y., Troy—H. S. H. Co., R. C. Hilton, Purch. Agt.—automatic paper punching and cutting equipment to cut bottle caps out of board.

N. Y., Watertown—The Greens Pastry Shoppe, 228 Goodale St., C. E. Green, Purch. Agt.—mixing and baking equipment for bread and pastry, (electricity for power gas fuel).

N. C., Gibsonville — The Gibsonville Hosiery Mills Co., A. B. Owen, Secy.-Treas. —several 200, 220 or 240 needle ribbers any make, 3½ in. or 3¾ in.

N. C., High Point—R. K. Stewart & Son, R. K. Stewart, Purch. Agt.—Lidgerwood or Stroudsburg double drum hoisting engine and 25 hp. boiler.

N. C., Raleigh—Stanton Bros., J. Stanton, Purch. Agt.—machinery and equipment for dairy at Wilmington.

N. C., Wilmington—The Carters Production Wks., 210 South Water St., O. Carter, Purch. Agt.—machinery suitable for grinding and mixing material to make metal polish.

O., Akron—The Natl. Sulphur Co., Inc.—machinery and equipment for use in manufacture of insectide powders, sulphur refining, and sulphur products.

O., Cincinnati—The Jones Machine Tool Co., 435 East Pearl St., S. M. Jones, Purch. Agt.—one No. 23 New Brittain automatic, (used).

O., Cincinnati—T. Lee & Sons Co., 128 West 2nd St., R. E. Lee, Purch. Agt.—single end tenoning machine for woodwork, (used).

O., Cleveland—E. G. Bauer, 403 Union Bldg.—small double crank press; small toggle press; thread roller; thread miller (Hobber) about 3 in. x 12 in.; small Landis Universal grinder.

O., Cleveland—The Clinton Co., 6332 Bway.—one overhead bucket type crane conveyor.

O., Columbus—The Central Refractories Co., Ferris Bldg., A. N. Spencer, Vice Pres.—equipment for plant at New Lexington, including dryers, cutters and other brick making machinery.

O., Columbus—The Grandview Lumber Co., Grandview Ave. along the tracks of the Pennsylvania R.R., J. C. McNally, Mgr.—two woodworking machines and planer.

Okla., Hugo—The Hugo Canning & Preserving Co., W. T. Larimore, Secy.—complete line of machinery and equipment for plant for canning tomatoes, also pulping equipment.

Pa., Erie—The Erie Metal Furniture Co. —machinery for proposed factory for the manufacture of metal furniture.

Pa., Hyde Park—The Reading Towel Mfg. Co., Inc., J. R. Geibel, Pres., has purchased the Glasner Hosiery Mills in Reading, will move equipment and will also purchase one hundred looms and minor equipment.

Pa., Koppel—The Koppel Industrial Car & Equipment Co., manufacturers of mine cars and equipment—one 7½ ton crane.

Pa., Mansfield—C. M. Thompson—complete equipment for repair and charging of storage cells for plant at Wellsboro.

Pa., Phila.—The American Dye Wks., Inc., Tulip and Westmoreland Sts.—balling machine suitable for balling hand knitting yarn.

Pa., Phila.—W. Gadke, 2222 West Huntingdon St., (auto business)—one 16 in. shaper in good condition.

Pa., Phila.—The Guarantee Knitting Mills, 514 Market St., automatic knitting machines, carding frames, finishing machines.

Pa., Phila.—The Shingle Leather Co., 315 Vine St.—$50,000 worth of leather working machinery for proposed factory.

Pa., Ridgway—F. K. Brown—complete equipment for bakery to replace that which was destroyed by fire.

S. C., Clinton—The Thornwell Orphanage, L. R. Lynn, Mgr.—complete line of laundry machinery.

S. C., Greenville—The Greenville Plating Wks., T. R. Machen, Pres.—machinery, equipment and supplies for metal plating.

Tenn., Knoxville — The Appalachian Marble Co., Middlebrook Park—air compressor, 300 to 500 cu.ft. capacity, motor or belt driven.

Tex., San Antonio—The Three Rivers Glass Co., Bedell Blvd., C. R. Tips, Secy.-Treas.—automatic glass blowing machinery for use in plant with daily capacity of from 100 to 300 gross bottles.

Tex., Texas City—The Texas City Sun, (Sun Printing Co.)—linotype and intertype for printing plant.

Va., Altavista—Telepost Publishing Co.—W. M. Hundley, Mgr.—complete line of machinery and equipment for proposed newspaper plant.

Va., Radford—The Amer. Steam Laundry Co., W. H. Painter, Pres.—complete line of laundry machinery.

Va., Richmond—The Kimker Service Co., 1205 West Broad St., A. P. Moore, Purch. Agt.—vulcanizing outfit for auto repair shop.

Va., Richmond—The Main St. Auto Supply Co., 1607 West Main St., A. L. Robinson, Purch. Agt.—vulcanizing outfit.

Va., Roanoke—The Liberty Laundry Co. —complete machinery and equipment for laundry.

Va., Roanoke—The White Fdry. Co., 613 10th Ave., H. H. White, Pres. and Mgr.—complete line of foundry machinery and equipment for small foundry.

Va., Smithfield—Sykes & Gwaltney, W. Sykes, Purch. Agt.—oil burning equipment for present planing mill, also miscellaneous woodworking equipment and machinery.

W. Va., Buckhannon—The LaBoard Furniture Co.—Dovetailing machinery for the manufacture of tables.

Wis., Kenosha—The Kenosha Milk Products Co., T. W. Powell, Secy.—refrigeration machinery for proposed milk factory on Bain St.

Wis., Milwaukee—B. Ihlenfeld, 1198 North Pierce St.—one 26 in. to 30 in. band saw.

Wis., Milwaukee—The Milwaukee Bedding Co., 256 South Water St., E. Schilling, Purch. Agt.—special feather renovating machinery and power stitchers.

Wis., Rhinelander—The Oneida Milk & Ice Cream Co., W. Gilley, Purch. Agt.—ice cream making and dairy plant equipment, (power).

Wis., Sheboygan—The city, c/o C. W. Boley, City Hall, City Engr.—manual training equipment for new high school.

Wis., Wausau—H. E. Bonsa—auto repair machinery for proposed garage.

Ont., Hamilton — Townsend, Krug & Greaves, forgings and cutlery, M. J. Krug, Purch. Agt.—forging machinery and equipment for the manufacture of knife and razor blades.

Ont., St. Thomas—D. Barr—materials and equipment for oil and gas drilling.

Ont., Toronto—The Dominion Combing Mills, Ltd., 709 Continental Life Bldg.—machinery for proposed wool combing and washing plant at Trenton.

Ont., Toronto—The Meyers Lumber Co., 15 Toronto St.—planers, saws and woodworking equipment for proposed planing mill on Spadina Rd.

Ont., Welland—The Lackawanna Tubes, Ltd.—machinery for the manufacture of seamless boiler tubes.

Que., Montreal—The Empire Brass Fdry., 128 Wellington St., A. Smith, Purch. Agt.—complete equipment for brass foundry.

Metal Working Shops

Cal., Oakland—The Magnovox Co., 2725 East 14th St., is having plans prepared for the construction of a 2 story, 60 x 200 ft. addition to its factory on East 14th St. for the manufacture of telephones and land speaking devices. Estimated cost, $60,000. B. J. S. Cahill, Easton Bldg., Archt.

Cal., San Francisco—L. H. and E. W. Allyne, 2609 Gough St., have awarded the contract for the construction of a 2 story, 98 x 137 ft. garage on Pine St. near Polk St. Estimated cost, $40,000.

Cal., San Francisco—T. W. Corder, Inc., c/o S. Schell, 180 Jessie St., has awarded the contract for the construction of a 1 story, 25 x 75 ft. addition to his elevator shop on Natoma St. near 7th St. Estimated cost, $5,000.

Cal., San Francisco—W. P. Stoesser, 53 Shotwell St., will build a 1 story, 25 x 122 ft. lock manufacturing plant on Shotwell St. near 14th St. Estimated cost, $5,000.

Col., Denver—The Super Service Motor Co., 410 Colorado Bldg., has awarded the contract for the construction of a 3 story, 115 x 210 ft. service garage on 7th and Speer Blvd. Estimated cost, $300,000.

Ill., Casey—The Western Radiator Corp. has awarded the contract for the construction of a 1 and 2 story, 150 x 260 ft. factory. Estimated cost, $100,000.

Mass., Everett—The Boston Elevated Ry. Co., 108 Massachusetts Ave., Boston, plans to build a repair shop, etc., here. Estimated cost, $750,000. M. L. Fernald, care of owner, Engr.

Mass., Everett—The Cameron Appliance Co., 48 Waters Ave., plans to build a 1 story, 70 x 115 ft. galvanizing factory at plant. Estimated cost, $40,000. MacVaughton & Robinson, 101 Tremont St., Boston, Archts.

Mass., Holyoke—The Magna Auto Co., 2 Division St., has awarded the contract for the construction of a 2 story, 116 x 120 ft. garage and service station on Northampton St. Estimated cost, $40,000.

Mass., Medford—The Amer. Radio & Research Corp. has awarded the contract for the construction of a 2 story, 61 x 120 ft. radio factory. Estimated cost, $50,000. Noted April 27.

Mass., Northampton—P. P. Gleason, Pearl St., will soon award the contract for the construction of a 2 story, 80 x 130 ft. garage and service station on Pleasant St. Estimated cost, $50,000. G. P. B. Alderman & Bro., 318 High St., Holyoke, Archts.

Mass., Willimansett (Holyoke P. O.)—The Palmer Steel Co., 316 High St., Holyoke, will soon award the contract for the construction of a 1 story, 80 x 200 ft. steel fabricating plant along the railroad tracks, here. Estimated cost, $75,000. Private plans.

Mich., Detroit—The Auto Collapsible Rim Co., Inc., c/o P. R. Rossello, Archt., 406 Congress Bldg., is having plans prepared for the construction of an 8 story, 110 x 166 ft. auto rim factory on Bellevue Ave. Estimated cost, $500,000.

Mich., St. Joseph—The Auto Specialty Mfg. Co. will soon award the contract for the construction of a 1 story addition to its factory. Estimated cost, $100,000. Davidson & Weiss, 53 West Jackson Blvd., Chicago, Archts. Noted Feb. 23.

Minn., St. Paul—The Siems-Stembel Co., 2700 Como Ave. W., will build a 1 story, 230 x 750 ft. car repair shop on Como Ave. W. Estimated cost, $75,000.

Mo., Carthage—The Leggett & Platt Bed Spring Co. plans to build a factory on Vine St. for the manufacture of bed springs. Estimated cost, $50,000. C. B. Platt, Mgr. Architect not selected.

N. J., Camden—The Neel Cadillac Co., 525 Market St., is having plans prepared for the construction of a 2 story, 80 x 175 ft. garage and service station on Federal St. Estimated cost, $75,000. Lakey & Hettle, 5 Hudson St., Archts.

N. Y., Brooklyn—The Kroder & Reubel Co., 107 East 17th St., New York City, will soon award the contract for the construction of a 3 story factory on Henry St., for the manufacture of brass goods. Estimated cost, $150,000. R. Berger & Son, 309 Bway., New York City, Archts. and Engrs.

N. Y., Buffalo—The Crane Co., 836 South Michigan Ave., Chicago, Ill., has purchased a site along the Erie Canal at the foot of Church and Genesee Sts., and plans to build a 200 x 222 x 282 ft. plumbing plant, here. Estimated cost, $250,000. F. Zander, 81 Bway., Buffalo, Local Mgr. Architect not announced.

N. Y., Buffalo—The Natl. Lamp Wks. of the General Electric Co., 1495 Fillmore Ave., plans to build a 1 story, 38 x 43 ft. machine shop on Fillmore Ave. Estimated cost, $15,000. Architect not announced.

N. Y., Buffalo—H. Wolcott, 3042 Main St., plans to build a 50 x 100 ft. charging station and small shop on Main St. Estimated cost, $5,000. Architect not announced.

N. Y., Gouverneur—The City will vote on $80,000 bonds May 10 for fire station equipment, storage and machine repair station. Address G. E. Dawley, Pres.

N. Y., New York—W. C. Bergen, c/o C. S. Clark, Archt. and Engr., 441 Tremont Ave., will build a 2 story garage on Webster Ave. Estimated cost, $150,000.

N. Y., New York—[illegible] Kaufman, c/o A. J. Simberg, Archt. 1133 Bway., is having plans prepared for the construction of a 2 story, 90 x 150 ft. garage at 225 St. Nicholas Ave. Estimated cost, $100,000.

N. Y., New York—Lampert Estate, c/o Euell & Euell, Archts., 125 Sherman Ave., is having plans prepared for the construction of a 1 story, 100 x 199 ft. garage on 10th Ave. Estimated cost, $100,000.

N. Y., Rochester—The Vogt Mfg. Co., 408 St. Paul St., is having plans prepared for the construction of a 48 x 127 ft. factory on Emmett St. for the manufacture of iron and steel specialties. Estimated cost, $10,000. Architect not announced.

N. Y., Utica—E. Steinhorst has awarded the contract for the construction of a 1 story, 70 x 140 ft. sheet metal plant at Mohawk and Eagle Sts. Estimated cost, $20,000.

O., Euclid—M. Brewer and J. B. Clark, 18601 Abbey Rd., have had plans prepared for the construction of two 1 story garages 48 x 80 ft. and 40 x 50 ft., at Stop 10½ Euclid Ave. Estimated cost, $40,000. Private plans.

O., Marion—The Commercial Steel Castings Co., manufacturers of open hearth steel castings, has awarded the contract for the construction of buildings and additions to present plant.

O., Silica—(Sylvania P. O.)—The Sandusky Cement Co., Engineers Bldg., Cleveland, has awarded the contract for the construction of a 1 story, 40 x 240 ft. office, storage and repair shop. Estimated cost, $150,000.

Pa., Bridgeport—Gehret Bros. are receiving bids for the construction of a 1 story, 80 x 120 x 200 ft. structural steel fabricating plant. Estimated cost, $50,000. Private plant.

Pa., Chester—The Chester Dairy Co. will build a 1 story, 45 x 150 ft. metal works plant on 9th and Hyatt Sts. Estimated cost, $50,000.

Pa., Corapolis—Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y., is having plans prepared for the construction of a steel foundry plant along the tracks of the Pennsylvania & Lake Erie R. R. here. Estimated cost, $75,000. Private plans.

Pa., Erie—The Erie Metal Furniture Co. will soon award the contract for the construction of a 1 story, 120 x 200 ft. metal furniture factory. Estimated cost, $65,000. Architect not announced.

Pa., Erie—The Union Iron Wks., Inc., will build factory for the manufacture of machinery, etc., to replace the one destroyed by fire. Estimated cost, $100,000.

Pa., Phila.—J. J. Greenberg, Morris Bldg., is having plans prepared for the construction of a 6 story, 55 x 150 ft. sales and service station at 1409-11 Broad St. Estimated cost, $200,000. L. B. Rothchild, 1225 Samson St., Archt.

Pa., Phila.—The International Harvester Co., 21 North 23rd St., has awarded the contract for the contruction of a 5 story, 100 x 130 ft. warehouse and a 1 story, 64 x 100 x 140 ft. service station on 16th St. and Indiana Ave. Estimated cost, $500,000. Noted April 13.

Pa., Phila.—L. J. Kolb, 10th and Reed Sts., has awarded the contract for the construction of a 2 story garage on Ridge Ave. and Lenon St. Estimated cost, $52,600.

Pa., Phila.—G. H. Seddon, 31st St. and Sunnyside Ave., has awarded the contract for the construction of a 1 story, 84 x 101 ft. garage on Ridge and Midvale Aves. Estimated cost, $40,000.

Pa., Phila.—F. J. Stokes Machine Co., 17th St. and Columbia Ave., will build a 1 story, 91 x 140 ft. machine shop, Tabor Rd. and Perry St. Estimated cost, $15,000.

Va., Norfolk—Lowenberg-Goodman Corp., 127 Granby St., will soon award the contract for the construction of a 2 story, 91 x 305 ft. garage on Granby and 11th Sts. Estimated cost, $150,000. Calrow & Wrenn, New Monroe Bldg., Archt.

Wis., Madison—A. E. Small, Archt., Ellsworth Bldg., will open bids about May 10 for the construction of a 1 story, 60 x 186 ft. garage on University St., for W. F. Clark, 2105 Keyes Ave. Estimated cost, $45,000. Noted April 13.

Wis., Wausau—H. E. Bonsa is having plans prepared for the construction of a 1 story, 50 x 95 ft. garage. Estimated cost, $40,000. O. [illegible]ser eimer & Obel, Spencer Bldg., Archt.

Ont., Wallaceburg—The Prestolock Co., of Canada plans to build a factory for the manufacture of automobile locks and radio equipment. Estimated cost, $20,000. E. E. Theis, Pres. Architect not selected.

Ont., Welland—The Lackawanna Tubes, Ltd., plans to build an 80 x 400 ft. addition to its factory for the manufacture of seamless boiler tubes. Architect not announced.

General Manufacturing

Cal., Monte Vista—The Monte Vista Packing Co. has had plans prepared for the construction of a 1 story cannery. Estimated cost, $45,000. W. W. Breite, Clunie Bldg., San Francisco, Engr. and Construction Mgr.

Cal., Newcastle—The Newcastle Fruit Growers Assn. has awarded the contract for the construction of a 2 story, 90 x 110 ft. packing plant. Estimated cost, $150,000.

Cal., Newman—The Natl. Ice Cream Co., 371 Guerrero St., San Francisco, has awarded the contract for the construction of two additions to ice cream plant here, one 45 x 45 ft. and other 15 x 78 ft. Estimated cost, $27,000. Noted Feb. 9.

Cal., Pittsburg—The California Bean Growers Assn., 120 Battery St., San Francisco, is having plans prepared for the construction of a cannery and warehouse (first unit). Estimated cost, $100,000. MacDonald Eng. Co., 149 California St., San Francisco, Engrs.

Cal., San Leandro—Alameda County, Oakland, is having plans prepared for the construction of a 1 story laundry and a 1 story power house, on the County Infirmary site, here. Estimated cost, $60,000. H. H. Meyers, Kohl Bldg., San Francisco, Archt.

Cal., San Francisco—The Bothin Real Estate Co., Atlas Bldg., has awarded the contract for the construction of a 2 story knitting mill on Howard and 8th Sts. Estimated cost, $30,000. Snyder Bros. Knitting Mills, 804 Mission St., Lessee.

Fla., Loughman—The Everglades Cypress Lumber Co. will build lumber mill to replace the one destroyed by fire. Estimated cost, $175,000.

Ill., Chicago—The Baubien Novelty Co., 347 St. Johns St., has awarded the contract for the construction of a 1 story, 28 x 118 ft. factory on St. Johns St. Estimated cost, $10,000.

Mass., Adams—The Berkshire Cotton Mfg. Co. has awarded the contract for the construction of a 1 story, 50 x 170 ft. addition to its mill at plant. Estimated cost, $40,000.

Mass., Boston—The Nash Carriage Co., 841 Massachusetts Ave., Roxbury, plans to build a 1 story, 100 x 114 ft. carriage factory in the Roxbury Section. Estimated cost, $50,000. Architect not selected.

Mass., Clinton—The Bigelow-Hartford Carpet Co., 58 Main St., Thompsonville, Conn., will soon receive bids for the construction of a 1 story, 100 x 275 ft. dyehouse; a 4 story, 100 x 114 ft. headhouse at plant. Estimated cost, $250,000. C. T. Main, Inc., 201 Devonshire St., Boston, Archt. and Engr. Noted April 13.

Mass., North Billerica—The Talbot Mills has awarded the contract for the construction of a 4 story 77 x 210 ft. addition to mills.

Me., Sanford—The Goodall Worsted Co. has awarded the contract for the construction of a plant here, including a storehouse, combing and worsted yarn spinning buildings.

Mich., Sault-Ste-Marie—The Cadillac Lumber & Chemical Co., Cadillac, is having plans prepared for the construction of a 2 story, 95 x 280 ft. and 100 x 114 ft. saw mill with a 32 x 40 ft. engine room and steam power plant. Estimated cost, $200,000. C. Hall, 221 Grand Ave., Milwaukee, Wis., Engr.

Minn., Minneapolis—The North Star Woolen Mills Co., 228 South 2nd St., has awarded the contract for remodeling a 6 story, 44 x 98 ft. factory on 6th Ave., S., between 1st and 2nd Sts. Estimated cost, $60,000.

Mo., Joplin—Pitkin, Boyd & Neal Packing Co., 7th St., is receiving bids for the construction of a 2 story storage and refrigeration plant on 7th St. Estimated cost, $5,000. Private plans.

Mo., St. Louis—The Heil Packing Co., 2216 La Salle St., has awarded the contract for the construction of a 2 story, 40 x 100 ft. and 15 x 17 ft. addition to its packing plant. Estimated cost, $30,000. G. L. Heil, Pres.

N. H., Laconia—The Pitman Mfg. Co. is having plans prepared for improving and building a 3 story, 65 x 100 ft. addition to its factory. Estimated cost, $50,000. Lockwood, Greene & Co., 60 Federal St., Boston, Engrs.

N. J., Gloucester—C. C. Coolbaugh & Sons, 19th and Cambria Sts., Phila., are receiving bids for the construction of a 1 and 2 story lumber mills on Nickolson Rd. Estimated cost, $25,000. Private plans.

N. Y., Buffalo—W. H. Beale & Son, 171 Hollywood St., plans to build a 1 story, 18 x 26 x 70 ft. dairy plant on Hollywood St. Estimated cost between $4,500 and $5,000. Architect not announced.

N. Y., Buffalo—Klink & Shallon, Inc., 620 Babcock St., plans to build an addition to its packing plant on Babcock St. Estimated cost, $19,000. Architect not announced.

N. Y., Franklinville—The Ontario Cutlery Co. plans to build a 4 story, 72 x 200 ft. factory. Estimated cost, between $160,000 and $180,000.

N. Y., Natural Dam—The Aldrich Paper Co., Gouverneur, plans to build paper manufacturing plant to replace the one destroyed by fire several years ago. Estimated cost between $500,000 and $600,000. Address N. R. Caswell, Gouverneur.

O., Silica—(Sylvania P. O.)—The Sandusky Cement Co., Engineers Bldg., Cleveland, has had plans prepared for the construction of a 1 story cement plant here. Estimated cost, $1,000,000. W. B. Rawson, Engineers Bldg., Cleveland, Archt. and Engr.

Pa., Brockwayville—The Brockwayville Macaroni & Supply Co. is having plans prepared for the construction of a 2 story, 48 x 50 ft. factory. Estimated cost, $50,000. Private plans.

Pa., Phila.—Blumenthal Bros. will soon receive bids for the construction of a 4 story, 80 x 250 ft. cocoa factory on Margaret and James Sts. Estimated cost, $180,000. Ballinger & Co., 12th and Chestnut Sts., Archts.

Pa., Phila.—J. Frank & Sons, 32 North 3rd St., are having plans prepared for the construction of a 2 story, 18 x 200 ft. warehouse and hat factory on North 3rd St. Estimated cost, $35,000. B. Brown, Drexel Bldg., Archt.

Pa., Phila.—The Kensington Ice Co. has awarded the contract for the construction of a 2 story, 65 x 112 ft. ice manufacturing plant on Lackawanna and Church Sts. Estimated cost, $15,000.

Pa., Phila.—W. P. Kreiss & Co., 1708 North Front St., has awarded the contract for the construction of a 2 story, 50 x 146 ft. bedding factory on Trenton and Auburn Aves. Estimated cost, $35,000.

Pa., Phila.—S. Weitz, c/o D. D. Weitz, Archt., Real Estate Trust Bldg., has awarded the contract for the construction of a 1 story, 62 x 72 ft. and 1 story, 18 x 91 ft. slaughtering plant and garage at 2838 North 28th St. Estimated cost, $60,000.

Pa., Phoenixville—The Weiland Packing Co. will build a 2 story, 52 x 62 ft. and 29 x 79 ft. packing plant. Noted April 20.

Va., Altavista—The Telepost Publishing Co., will receive bids until June 1 for the construction of a 1 story, 40 x 60 ft. newspaper plant. Estimated cost, $16,000. W. M. Hundley, Mgr. G. Stone, Altavista, Archt.

Va., Radford—The Amer. Steam Laundry Co. plans to build a 2 story, 40 x 100 ft. laundry. Estimated cost, $15,000. W. H. Painter, Pres. Architect not selected

Wis., Kenosha—The Kenosha Milk Products Co., has awarded the contract for the construction of a 1 story, 50 x 75 ft. milk factory on Bain St. Estimated cost, $75,000. T. W. Powell, Secy.

Wyo., Yoder—C. W. Goodrich, Casper, plans to build a brick plant here.

Ont., St. Marys—The Hurlburt Shoe Co. is having plans prepared for the construction of a 2 story, 50 x 60 ft. addition to its shoe factory. Estimated cost $25,000. C. E. Hurlburt, Mgr. Private plans.

Ont., Toronto—The Meyers Lumber Co., 15 Toronto St., will build a planing mill, to consist of a 2 story 70 x 80 ft. lumber mill; 1 story, 28 x 34 ft. office and a 2 story, 28 x 34 ft. stable, on Spadina Rd. Estimated cost, $25,000. Private plans.

Ont., Trenton—The Dominion Combing Mills, Ltd., 709 Continental Life Bldg., Toronto, will soon award the contract for the construction of a wool combing and washing plant here. Estimated cost, $200,000. B. H. Prack, 50 Bay St., Toronto, Archt.